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STOCK PRICE REACTION TO THE DEPRECIATION SWITCH AND ITS TAX IMPLICATION

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I. Introduction

The Business Accounting Principle in Japan, just like the generally accepted accounting principles in the United States and other countries, permits alternative treatments for several types of accounting events and transactions. It requires that the accounting method once adopted should not be changed unless the firm justifies the use of an alternative acceptable method. The requirement of consistent use of accounting method stems from concern that the stock market might be systematically misled by changes in accounting methods.

It can be hypothesized in one extreme that investors take accounting numbers at face value without adjustments for accounting changes. Hence, the stock market as a whole reacts mechanically to the manipulated earnings number. On the other extreme, it can be imagined that investors see through the manipulation and interpret the accounting number after making the necessary adjustment for the change. This is possible since the effect of the change on income is required to be disclosed when a firm changes its accounting method. In this case, no stock price changes are associated with voluntary changes in the accounting method unless the change affects the cash flow of the firm. The former scenario can be called as the misled-reaction hypothesis and the latter as the see-through hypothesis.

The objectives of this study is to discriminate empirically between these two hypotheses with respect to the effect of accounting changes on stock prices. The test involves changes in depreciation methods by the firms listed on the first section of the Tokyo Stock Exchange. In the United States, the depreciation method for tax purpose need not be the same as for reporting purpose. Therefore the depreciation switch for reporting purpose has no effect on tax payment. In contrast, the depreciation switch in Japan affects

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corporate tax and hence affects cash flow directly. This is caused by Japanese tax law not allowing deductions from taxable income greater than the expense in the financial statements for reporting purposes.

This paper presents the evidence which is consistent with the see-through hypothesis. That is, (1) stock price behavior is more consistent with the income number after adjustment for depreciation switch than the number as presented, and (2) the market capitalizes the tax benefit from the switch.

Section 2 outlines typical depreciation methods and the accounting treatment for its change in the generally accepted accounting principles in Japan. Section 3 reviews the previous studies conducted in the United States and Japan regarding stock price reaction to accounting changes. The sample of this study and its major characteristics are described in section 4. Section 5 explains the test methodology employed and the related variables. The empirical results and its interpretation are presented in section 6. Section 7 offers some conclusions.

II. Depreciation Accounting in Japan

Two typical methods of depreciation in Japan are the declining-balance method and the straight-line method. About three quarters of the listed firms use the former and one quarter use the latter. Few firms, if any, use the production method or the sum-of-the-years'-digits method.

In the declining-balance method, the depreciation charge is calculated by multiplying the net book value of the asset (acquisition cost less accumulated depreciation) at the start of each period by a fixed rate. The rate is determined through the following formula,

$$\text{fixed rate} = 1 - \sqrt[n]{S/C},$$

where n is the estimated periods of service life, S is estimated salvage value and C is the acquisition cost.

The number of years of service life is prescribed for each kind and use of asset by departmental regulation of the Ministry of Finance for the tax purpose. The regulation also prescribes the salvage value as equal to ten percent of acquisition cost for all kinds of depreciating assets. The rates, therefore, are determined automatically based on the legal useful life and the legal salvage value. Almost all of the Japanese firms apply this legal rate not only for taxes but also for financial reporting.

Under the straight-line method, the acquisition cost of the asset minus its estimated salvage value (10%), is devided by the legal number of years of its expected life in order to arrive at the annual depreciation.

When a firm changes from declining-balance depreciation to straight-line, the annual depreciation expense after the change is calculated as follows. That is, the net book value of the asset at the start of the period of the change minus the legal salvage value is divided by the remaining years of legal useful life. Therefore, the changes always reduce the depreciation expense and hence increase the reported earnings in the change year, compaired to the earnings that would have reported under the consistent use of the declining-balance method.

On the other hand, the annual depreciation in and after the period of the change to the declining-balance depreciation, is calculated by multiplying the net book value of the asset at the beginning of the change period by the fixed rate through the above formula. In this case, however, the remaining years of legal useful life is used. The changes to the declining-balance depreciation, therefore, always increase the depreciation expense and result in the decrease of the reported earnings in the change year.

The accounting principle requires firms which change the accounting method to disclose the nature and justification of the change and its effect on income in a footnote in the financial statements for the period in which the change is made. The value of the effect is calculated as the difference between income as reported under the change and income that would have been reported if the firm did not make the change. The auditors are required to report the fact that the firm changed the accounting method and the opinion whether the change is justified.

This information makes it possible for the investors to make the necessary adjustment for the earnings effect from the accounting change. Therefore, if the see-through hypothesis has a descriptive validity, the stock price behavior of the firms which change their depreciation methods is more consistent with the income number after adjustment than with the number as presented. On the contrary, if the market takes the income number at face value, the stock price behavior is more closely associated with the reported income than with the income after adjustment.

One of the characteristics of the income measurement in Japan is strong effects from the corporate income tax law. In the United States, the

accounting methods used for income tax and financial reporting purposes do not have to be the same, and therefore the accounting changes for the reporting purpose generally have no effect on firms' income taxes except for the case of a change to or from the LIFO inventory method.

In contrast to the situation in the United States, almost all of accounting changes in Japan have direct cash flow effects through tax payments. This results from the fact that Japanese corporate income tax law does not allow deductions from taxable income greater than the expense in the financial statements for reporting purposes.

This situation gives a chance to empirically discriminate between the above-mentioned hypotheses by investigating whether the market revalues the shares of firms switching depreciation in response to the resulting gain or abandonment of tax benefit from the switch.

III. Review of Previous Research

Though Ball (1972) and Harrison (1977, 1978) investigated all types of accounting changes at once, empirical research in this field in the United States is usually grouped into two classes: changes without direct effects on income tax and changes related to the LIFO method that have a direct effect on cash flow through tax payment.

The former includes Archbald (1967, 1972) and Kaplan and Roll (1972) on the depreciation switchback from acceralated to straight-line depreciation, and Kaplan and Roll (1972) and Cassidy (1976) on the accounting changes for the investment tax credit. Early studies on the LIFO changes are those of Sunder (1973, 1975), Abdel-khalik and McKeown (1978) and Brown (1980). While most papers generally concluded that the market reacted rationally to the accounting changes, they suffer from a disturbing feature of their methodology. No control is made for the effect of the unexpected earnings on the stock returns.

Ricks (1982) controlled for the effect of unexpected earnings using matched-pair sample design and presented evidence which favored the misled-reaction hypothesis: the stock returns of LIFO adopters were negative and significantly lower than the return of firms not using LIFO. Evidence by Biddle and Lindahl (1982), however, based on the cross-sectional regression of cumulative abnormal return on unexpected earnings

and LIFO tax saving, suggested that the market capitalized the benefit from the tax saving. Murry (1983) showed sensitiveness of the results from matched-pair design to the extent of rigorous control for the effects of the unexpected earnings. Then, Biddle and Ricks (1988) resolved the mixed findings by presenting evidence that negative excess returns observed by Ricks (1982) were not due to the misled market reaction. They were due to negative unexpected earnings caused by systematic overestimation of earnings of firms adopting LIFO.

With respect to the Tokyo Stock Exchange, Ishizuka and Hah (1986) picked up firms which changed their accounting methods between 1980 and 1983. They tried to discriminate between the two hypotheses by compairing the cumulative abnormal returns among firms with income increasing accounting changes, firms with income reducing changes and firms which did not change their accounting methods. Sakurai (1987) compaired the cumulative abnormal returns between the firms that changed from declining-balance to straight-line depreciation and the firms that changed from straight-line to declining-balance depreciation. The study covered changes occuring between 1976 and 1985. Kohmura (1987) also investigated the depreciation switch using the matched pair design like Ricks (1982).

Though these empirical findings on the Japanese firms suggest that the market is not misled by the accounting change, the strict discrimination of the two hypothesis is difficult because these studies did not control sufficiently for the effect of unexpected earnings on the stock return. This study is designed to discriminate between the two hypotheses clearly by investigating whether a positive association is observed between the magnitudes of cumulative excess returns and the magnitudes of tax benefit related to the depreciation switches. The results are controlled for unexpected earnings through a cross-sectional regression of the cumulative abnormal return on the unexpected earnings and the tax saving.

IV. Sample and Its Characteristics

The sample for this research consists of 88 firm/years switching from declining-balance to straight-line depreciation and 121 firm/years switching from straight-line to declining-balance depreciation. The switch took place in fiscal years ended between March 1, 1976 and December 31, 1988. Some

firms changed their depreciation method more than once during the period. They are counted twice or more.

Table 1 presents the distribution of depreciation switch years. Unlike the clustering of LIFO changes in the United States in 1974, it shows a fairly wide dispersion of calender years for the switches of both directions.

Table 1 Distribution of Switch Years

Switch Year	1976	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88	Total
No. of Firms Switching from DB to SL	9	15	14	10	5	5	8	5	4	1	1	10	1	88
No. of Firms Switching from DB to SL	3	2	6	12	12	18	14	6	17	7	6	6	12	121

DB and SL represent the declining-balance and the straight-line depreciation.

The industry profile of the sample is given in Table 2 along with the number of listed firms on the first section of the Tokyo Stock Exchange as of December 1988. It is clear that some industries dominate the sample. Relatively higher frequency of change from declining-balance to straight-line depreciation is observed in iron and steel, oil and coal products, pulp and paper, and marine transportation. By contrast, firms in electric and gas, marine transportation, iron and steel, and real estate change with relatively higher frequency from straight-line to declining-balance depreciation.

Therefore, this study calculates cumulative abnormal returns of individual securities using a multi-index version of the market model which includes an industry index in addition to a market index. An ordinary market model is appropriate for a sample distributed randomly among industries.

The second characteristics of the sample is selection bias regarding earnings performance. Firms switching from declining-balance to straight-line depreciation are more likely to be poor performers. Firms switching from straight-line to declining-balance depreciation are more likely to be enjoying a profitable year.

Table 2 Industry Profile of Sample

Industry	No. of Listed Firms	No. of Change from DB to SL	No. of Change from SL to DB
Fisheries	6	0	1
Mining	7	0	0
Construction	91	1	1
Food	55	0	3
Textile	43	4	3
Pulp and Paper	19	6	3
Chemicals	121	11	11
Oil and Coal Products	9	4	2
Rubber Products	9	1	0
Glass and Ceramics	31	4	2
Iron and Steel	36	18	14
Non-ferro Metals	24	4	2
Metal Products	22	1	1
Machinery	86	6	6
Electrical Machinery	106	2	3
Transportation Equipment	49	8	5
Precision Instrument	18	0	0
Other Products	28	1	1
Commerce	125	2	1
Banking and Insurance	128	1	1
Real Estate	18	1	5
Land Transportation	25	3	8
Marine Transportation	14	5	7
Air Transportation	4	0	1
Warehouse	10	1	0
Communication	5	0	0
Electric and Gas	14	2	40
Service	25	2	0
Total	1,128	88	121

Table 3 shows the average trends of earnings performance measured by the rate of return on investment (hereafter *ROI*) for each group from five years before to the year of the switch. The one group consists of 88 firm/years switching from declining-balance to straight-line depreciation, and the other consists of 121 firm/years switching from straight-line to declining-balance depreciation. Average trend of *ROI* for each group is calculated as

follows.

$$ROI_t = \frac{1}{N}\sum_{j=1}^{N}\frac{ROI_{it} - \overline{ROI_i}}{\sigma(ROI_i)} \qquad \text{for } t = -5, -4, \ldots, -1, 0$$

where N is the number of firm/years in each group. ROI_{it} is rate of return on investment of firm/year i for period t, which is defined as the ordinary income devided by the book value of the total assets at the beginning of the year. $\overline{ROI_i}$ and $\sigma\ (ROI_i)$ are mean and standard deviation of ROI for firm/year i based on the time series of the five years before the switch ($t = -5, \ldots, -1$). Two types of ROI are calculated for the switch year: the one based on earnings as presented without adjustment for the earnings effect from the switch, and the other based on "as if" earnings which would be reported if the firm did not change the depreciation method.

Table 3 Average Trend of ROI

Accounting Period	−5	−4	−3	−2	−1	Year of Switch: reported earnings	Year of Switch: "as if" earnings
Firms Switching from DB to SL	0.28	0.20	0.34	0.01	−0.83	−0.87	−1.22
Firms Switching from SL to DB	−0.10	−0.20	0.10	−0.05	0.25	0.87	1.35

Firms switching to straight-line depreciation report substantially poor ROI in the year of, or the year just before, the switch. They would have experienced further drop of ROI in the year of switch had they not changed to straight-line depreciation. These firms have negative current unexpected earnings.

Firms switching to declining-balance depreciation, on the other hand, have remarkably improved ROI in the year of the switch even based on the reported earnings without adjustment. They would have shown a striking increase in ROI had they not change to declining-balance depreciation. These firms have positive current unexpected earnings.

This evidence indicates a selection bias in the firms that change their depreciation methods. This selection bias suggests that it is important to

control for contemporaneous unexpected earnings when investigating abnormal return behavior associated with the depreciation switch.

V. Methodology

(1) Regression Model

Following three regression models are estimated cross-sectionally to discriminate between the misled-reaction hypothesis and the see-through hypothesis.

$$CAR_i = a_0 + a_1 UROI_i + e_i \quad (1)$$

$$CAR_i = b_0 + b_1 UROI'_i + e'_i \quad (2)$$

$$CAR_i = c_0 + c_1 UROI'_i + c_2 TB_i + u_i \quad (3)$$

where CAR_i is the cumulative abnormal return for firm i for 12 months up to the announcement of the first annual earnings affected by the switch, $UROI_i$ and $UROI'_i$ are the unexpected ROI based on the earnings number as presented without the adjustment for the switch and the "as if" earnings. TB_i is a variable for the tax benefit of the depreciation switch, and e_i, e'_i and u_i are error terms.

It is well known that the larger the unexpected earnings, the larger the abnormal return. See Beaver, Clarke and Wright (1979) and Sakakibara *et al.* (1988). Therefore, the statistically significant positive relation is expected between CAR and unexpected ROI. In addition, if the market sees through the switch, the relation is stronger in equation (2) than in equation (1).

Equation (3) adopts a direct approach to determining the extent to which the market reacts to the gain or the abandonment of the tax benefit associated with the switch. The coefficient of the tax benefit is expected to be significantly positive if market capitalizes the tax benefit.

(2) Stock Price Behavior

Stock price behavior is investigated using the cumulative abnormal rates of return for each firm/year over 12 months period ending the month of the preliminary annual earnings announcement. Estimates of abnormal rates of return are obtained with a following version of the market model including the industry index because the sample clusters in some industries.

$$R_{it} = \alpha + \beta_1 R_{mt} + \beta_2 R_{st} + \epsilon_{it} \qquad (4)$$

where R_{it}, R_{mt} and R_{st} are monthly rates of return on security i, market index, and index of industry s in month t, respectively. Market index and industry index cover all firms listed on the first section of the Tokyo Stock Exchange. They are compiled by the Japan Securities Research Institute.

At first, the industry index is made orthogonal to the general market index by regressing industry rates of return on the general market rates of return over month -71 to -12, defining month 0 as the preliminary earnings announcement month. The residuals from this regression are used as the industry rates of return. Next, estimates of parameters of multi-index version of the market model are derived from a time-series OLS regression over month -71 to -12. Then abnormal rates of return for each month from month -11 to 0 are calculated as residual from the estimation of the multi-index model, and CAR_i is just the sum of the 12 monthly abnormal return.

Table 4 gives the average results of the estimation of multi-index model. The average is calculated for all of 209 firm/years in the sample, and for 179 firm/years which can reject the null hypothesis [$H_0 : \beta_1 = \beta_2 = 0$] in the estimation of equation (4) at the 5 percent significance level in the F test. Average β_1 is well below one, reflecting the fact that the sample includes many electric utilities whose betas are arround 0.6.

Table 4 Average Results of Multi-index Model Estimation

	Size	α	β_1	β_2	Adj.R^2
Partial Sample	179	0.0043	0.8677	0.9302	0.4599
Total Sample	209	0.0053	0.7993	0.8433	0.3939

(3) Unexpected Earnings Performance

Unexpected *ROI* is the difference between the expected *ROI* and the actual *ROI*. Expected *ROI* in year t is derived from the random walk with drift model as follows.

$$E(ROI_t) = ROI_{t-1} + \frac{1}{5} \sum_{k=1}^{5} (ROI_{t-k} - ROI_{t-k-1})$$

where *ROI* is defined as the ordinary income divided by the book value of the total assets at the beginning of the change year.

Two types of actual earnings are used in achieving the unexpected *ROI* of the change year. One is the earnings as presented without adjustment for the switch, and the other is the "as if" earnings. Therefore two kinds of unexpected *ROI* are derived for each firm. They are put into regression model (1) and (2) for the purpose of compairing the coefficient of determination.

(4) Tax Benefit

It is not possible to calculate the exact amount of tax benefit due to the depreciation switch. Not only is detailed information in tax returns not disclosed and interperiod tax allocation is not required in the corporate disclosure system in Japan, but also the depreciation change affects the stream of tax payment in future periods in addition to current year.

This study approximates the relative magnitude of the tax benefit associated with the depreciation switch of each firm in the following way. The Japanese firms are required to pay three kinds of income tax called Houjin-zei (corporate income tax paid to the central government), Juumin-zei (income tax paid to the local government, both prefecture and city), and Jigyou-zei (business tax). The rates of each tax are shown in Table 5. The tax rates of Houjin-zei and Jigyou-zei are prescribed as a percentage of the taxable income. Note that the tax rate of the Juumin-zei is prescribed as a percentage of the amount of Houjin-zei.

Table 5 Tax Rate of Three Kinds of Income Tax

End of Accounting Period	Houjin-zei (% of income)	Juumin-zei (% of Houjin-zei)	Jigyou-zei (% of income)	Total (% of income)
Mar. 1, 1976 – Mar. 31, 1976	40 %	17.3 %	13.2 %	60.12 %
Apr. 1, 1976 – Mar. 31, 1981	40	20.7	13.2	61.48
Apr. 1, 1981 – Mar. 31, 1984	42	20.7	13.2	63.894
Apr. 1, 1984 – Mar. 31, 1987	43.3	20.7	13.2	65.4631
Apr. 1, 1987 – Dec. 31, 1988	42	20.7	13.2	63.894

The tax benefit in the year of the switch is estimated by multiplying the total tax rate by the effect of the switch on reported earnings, which is disclosed in the footnote to the financial statements. Then the amount of the tax benefit is standardized by dividing the aggregate market value of the shares outstanding at the beginning of the switch year.

This measure may not be a good surrogate for two reasons. First, the effect on reported earnings instead of taxable income is used. However, this does not seem to cause serious measurement error because Takao (1984) reported the almost perfect cross-sectional correlation between the taxable income and net income before tax for reporting purpose. That is, the coefficient of correlation was 0.9882. The sample for this estimation was the 756 non-financial firms listed on the first section of the Tokyo Stock Exchange in 1982. Second, the measure focuses on the effect in the year of change, ignoring the effect in future periods, except for 42 firms out of 88 firms changing from declining-balance to straight-line depreciation. These 42 firms seem to have negative number of taxable income even after the depreciation switch. It means the depreciation switch does not cause the increase in the tax payments for them as long as the year of change. However, the switch could cause the increase in the tax payments in future periods. This is because the Japanese tax law allows firms to carry forward the net loss to offset taxable income generated during the next 5 years. Therefore, the number derived by multiplying tax rate by the effect on reported earnings is used, instead of zero, as the measure of abandonment of the tax benefit.

VI. Empirical Results

Regression results are presented in Table 6 for both 179 firm/years of the partial sample and for the total sample of 209 firm/years. The partial sample consists of the firm/years to which the multi-index market model are well specified.

The coefficient on the unexpected *ROI* term is positive and significantly different from zero in all estimates. This would be expected given the previous results of Beaver, Clarke and Wright (1979) and so on. The regression model of equation (1) using the *UROI* measure (based on the earnings as presented without the adjustment for the switch) explains

Table 6 Regression Results

Estimated Equation (t-values in parentheses)	Adjusted R^2	Correlation Coefficient
Partial Sample (size = 179)		
(1) Reported Earnings $CAR_i = -0.0090 + 1.7557UROI_i$ $(t = -0.334)\quad (2.838)^{**}$	0.0381	–
(2) Adjusted Earnings $CAR_i = -0.0144 + 1.9160UROI'_i$ $(t = -0.534)\quad (3.159)^{**}$	0.0480	–
(3) Adjusted Earnings and Tax Benefit $CAR_i = -0.0128 + 1.8459UROI'_i + 1.5583TB_i$ $(t = -0.478)\quad (3.061)^{**}\quad (1.937)^{*}$	0.0626	0.0600
Total Sample (size = 209)		
(1) Reported Earnings $CAR_i = -0.0099 + 2.1577UROI_i$ $(t = -0.394)\quad (3.828)^{**}$	0.0616	–
(2) Adjusted Earnings $CAR_i = -0.0133 + 2.2371UROI'_i$ $(t = -0.527)\quad (4.083)^{**}$	0.0701	–
(3) Adjusted Earnings and Tax Benefit $CAR_i = -0.0101 + 2.1435UROI'_i + 1.5440TB_i$ $(t = -0.403)\quad (3.919)^{**}\quad (1.881)^{*}$	0.0813	0.0910

* and ** represent that the estimated coefficients are significantly greater than zero at the 5% and the 1% level with a one-tailed t-test.

approximately 3.8% of the variation in CAR in the partial sample. Use of $UROI'$ measure (based on the "as if" earnings) in equation (2) increases the adjusted R^2 value to 4.8% for the partial sample. For the total sample, the R^2 value increases from 6.2% in equation (1) to 7.0% in equation (2).

These results suggest that the magnitudes of cumulative abnormal returns are positively associated more strongly with the magnitudes of unexpected ROI based on the "as if" earnings than that based on the earnings as presented without the adjustment. It is safe to conclude that, under current reporting requirements, the market as a whole is clever enough to interpret the earnings performance after making the necessary adjustment

for the depreciation switch.

The coefficient on the tax benefit term in equation (3) is also positive and significantly different from zero at the five percent level in one-tailed test. The coefficient of correlation between unexpected *ROI* and tax benefit is low enough to remove the concern about multicolinearity. The results suggest that the cumulative excess returns are positively associated with the tax benefit. In other words, the evidence suggests that the null hypothesis of no association between stock return behavior and tax benefit should be rejected in favor of the alternative hypothesis that the market sees through the economic reality. That is, the depreciation switch is recognized as an accounting artifact. Further, the cash flow effect through the gain or abandonment of tax benefit associated with the switch is capitalized.

VII. Conclusions

The switch of depreciation between the straight-line and the declining-balance method can generate a large change not only in reported earnings but also in firms' cash flows due to the impact on tax payments under the Japanese tax laws. This situation provides an opportunity to discriminate between competing hypotheses regarding the market reaction to accounting changes. The misled-reaction hypothesis predicts that the market is systematically misled by the earnings manipulation through the accounting change. The see-through hypothesis, on the other hand, predicts that the market interprets the earnings performance after the adjustment for the accounting change and capitalizes the tax benefit associated with the change.

This study regressed the cumulative abnormal returns on the unexpected *ROI* and the tax benefit, instead of relying on a simple comparison of *CAR* based on dichotomous classification indicating whether or not a firm changed the depreciation method. The empirical results in this study are consistent with the see-through hypothesis in that (1) the market evaluates the earnings performance after making adjustment for the earnings effect of the depreciation switch, and that (2) the market capitalizes the gain or abandonment of the tax benefit associated with the switch.

It seems that the required disclosure on the earnings effect in the footnote makes it possible for the market to recognize the true impact of the depreciation switch. Therefore, the policy makers need not be too concern-

ed over the earnings manipulation from the accounting change. They should rather require enough disclosure for the investors to calculate the "as if" earnings and the tax benefit.

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