THE MANAGERIAL EARNINGS MANIPULATION OF R&D EXPENDITURES TO AVOID CONSECUTIVELY MISSING EARNINGS TARGETS: EVIDENCE FROM JAPAN

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ABSTRACT

This paper investigates whether Japanese firms reduce research and development (R&D) spending in response to short-term pressure on earnings and how capital market participants interpret such behavior. It is often insisted that R&D expenditures are the source of innovation and R&D intensive firms have possibility of future growth. However, R&D budgets are changeable and often subject to the managerial incentive to manipulate earnings for the purpose of achieving targets. Especially managerial decision-makings would be strongly affected by such incentives when earnings targets might be less than the salient earnings benchmark such as zero, last earnings number, and managerial earnings forecasts.

In this paper, two hypotheses are statistically tested from 2002 to 2006 using a sample of Japanese firms. From the empirical results, R&D expenditures were found to be sensitive to the lagged earnings performance relative to earnings targets. In particular, failure to beat or meet earnings forecast benchmarks in the previous period increases the R&D reductions in subsequent periods. Revealing a linkage between R&D expenditures and earnings targets, I explore how investors in capital markets interpret earnings in the presence of unexpected R&D budget adjustment. The results suggest that investors discount income-decreasing earnings management related to unexpected R&D budgets adjustment. Especially, investors place low assessments on firms with negative earnings or missing managers' earnings forecasts in the previous periods

Considering that R&D is greatly correlated with the innovation, which would result in the future growth, R&D should be highly evaluated by markets. However, the results in this paper implies that R&D expenditures discretionally managed to avoid missing the targets aren't innovative and that R&D expenditures do not always yield firms' innovation. Therefore investors should know the information contents incorporated in R&D outlays and pay adequate attention to the managerial financial reporting behaviors.

1. INTRODUCTION

This paper investigates whether research and development (R&D) expenditures are related to reported earnings and capital market valuations and examines whether the failure to beat or meet target earnings in the last year affects current R&D expenditures. When reported earnings in the previous year are lower than target earnings, managers face more pressure to achieve targets in the following year and are more sensitive to current reported earnings. As Bange and De Bondt (1998) states, managements heavily focus on not earnings levels but the shortfall or surplus in earnings relative to earnings target numbers, and they have a strong incentive to adjust the R&D expenditures in the current fiscal period. Therefore I address the managerial decision-making regarding R&D expenditures when the last earnings number failed to beat or meet targets.

Moreover, I also examine how capital market participants perceive the R&D expenditures manipulated by management when they fall short of earnings targets in previous periods. In some studies, the relationship between R&D expenditures and market valuation is explained from two perspectives. One explanation is that positive assessments associated with R&D compensate for risk; the other is that investors misprice earnings of R&D-active firms, leading to predictable growth.

So far, a lot of studies have investigated the linkage between the beat / meet earnings targets in the current year and managerial earnings management to avoid missing target numbers in the contemporary year. However, considering that the recognition and measuring in GAAP presumes the going-concern and firms to be expected to survive for long-term (Subramanyam and Wild, 1996), accumulation of the economic evidence regarding managerial behaviors from the long-term perspective is needed. Generally, R&D is also regarded as a source of innovation and previous research suggests that higher R&D expenditures of firms results in their higher evaluation by the capital markets, implying that R&D expenditures are value-relevant (Baysinger and Hoskisson, 1989; Hambrick and MacMillan, 1985; Hitt *et al*., 1997; Hoskisson and Hitt, 1988 etc.).

This study focuses on earnings management; therefore, understanding the accounting standard for R&D is important. A focus on this standard indicates an insignificant difference between IAS and the Japanese standard. One difference is the treatment of development costs. According to IAS 38, research expenditures may not be capitalized and development costs may be recognized as an asset only if the company

fulfills the following restrictive requirements[1]: (1) it has the technical feasibility to complete the intangible asset for use or sale; (2) it must intend to complete the asset for use or sale; (3) it must be able to actually use or sell the intangible asset; (4) a reasonable certainty must exist that the intangible asset will generate future economic benefits; (5) technical, financial, and other resources required for the completion and sale or use of the asset must be available; and (6) the firm must be able to measure the expenditures attributable to the intangible asset during its developmental phase.

To sum up, IAS 38 prohibits the capitalization of research expenditures but permits the capitalization of development costs if certain conditions are satisfied. Japanese standards require the immediate expensing of development and research costs and prohibit capitalization of development costs[2] because of the uncertainty of cash flows generated from R&D processes even if such R&D programs are ongoing. Thus, for Japanese firms, R&D costs have a greater influence on reported earnings because all R&D expenditures are incorporated into costs and subtracted from total sales as part of selling and general administrative expenses.

Figure 1 provides the R&D expenditures of all Japanese firms from 2000 to 2011. Until 2007, R&D outlays were less than ¥10,000 billion; however, after 2008, such outlays were confirmed to be more than ¥10,000 billion yen and recently, Japanese firms actively spent money on R&D.

[Insert Figure 1 about here]

This study addresses whether missing earnings targets in previous periods is related to managers' investment behavior in terms of R&D and how capital markets evaluate earnings management through R&D expenses when firms miss their earnings targets in the previous year. The analyses found that managers are more likely to reduce R&D investments when they missed earnings targets in preceding periods. Moreover, when reported earnings in the previous year were less than earnings targets and managers manipulated current earnings, investors placed low values on these firms.

[1] Research expenditures are spent on systematic investigations aimed at findings new knowledge. Meanwhile, development costs are outlays expensed with a view to dramatically improving existing goods and/or services.
[2] Until 1999, the Japanese accounting standard on R&D also permitted capitalization of R&D expenditures if certain requirements were fulfilled.

The remainder of this paper is organized as follows. Section 2 reviews the related literature and describes two hypotheses. Section 3 discusses the data and sample. Section 4 explains the research design and section 5 reports the empirical results. Section 6 concludes.

2. RELATED LITERATURE AND HYPOTHESES DEVELOPMENT

2.1. *Prior literature*

Studies regarding R&D are broadly classified into three categories. The first is research that investigates the difference between capitalizing and expensing R&D. In some countries, R&D expenditures may be capitalized if certain conditions are satisfied. Hence, some studies consider this and investigate the difference between capitalizing and expensing R&D outlays (Boone and Raman, 2001; Cazavan *et al*., 2011; Diewert and Huang, 2011; Kothari *et al*., 2002; Oswald, 2008; Oswald and Zarowin, 2007).

The second category concerns studies associated with market reactions to R&D outlays. Most such studies suggested that firms that spend more on R&D experience higher economic values (Ballester *et al*., 2003; Cazavan-Jeny and Jeanjean, 2006; Chambers *et al*., 2002; Chan *et al*., 2001; Chauvin and Hirschey, 1993; Donelson and Resutek, 2012; Franzen and Radhakrishnan, 2009; Green *et al*., 1996; Hall and Oriani, 2006; Han and Manry, 2004; Lev and Sougianiis, 1996; Zhao, 2002). These results imply that the market regards R&D outlays as a source of innovation and expects firms that spend significantly on R&D to potentially experience high future growth.

The third category analyzed how managers utilized R&D expenditures to manage earnings. Previous studies found that managers engaged in earnings management to avoid reporting losses, decreases in earnings, or missing earnings forecasts (Baber *et al*., 1991; Bange and De Bondt, 1998; Bushee, 1998; Das *et al*., 2009; Gunny, 2010; Mande *et al*., 2000; Markarian *et al*., 2008; Osma, 2008; Osma and Young, 2009; Wang, 2006).

2.2. *Earnings targets and earnings management with R&D*

This paper focuses on earnings management through investments in real activities. Several papers noted that managers face significant pressure to avoid reporting losses, earnings declines, and negative earnings surprises (Burgstahler and Dichev, 1997; Degeorge *et al*., 1999; Skinner and Sloan, 2002). One reason for such managerial behavior is that shareholders are likely to pay significant attention to heuristic earnings

benchmarks such as zero changes and earnings levels when assessing managerial and firm performance (Burgstahler and Dichev, 1997). Hence, managers may manipulate earnings upwards to beat / meet these benchmarks when earnings would no exceed targets without earnings management[3]. In terms of earnings management methods, previous research focused on discretionary accruals (Bartov *et al*., 2002), reclassification of expenses as extraordinary items (McVay, 2006), and share repurchases (Bens *et al*., 2003; Hribar *et al*., 2006) as well as management of real activities. This paper focuses on R&D expenditures as a means for managers to manipulate earnings because several studies indicate that managers utilize discretionary R&D expenditures to achieve current earnings targets.

Several previous studies documented the linkage between R&D expenditures and current earnings. However, the influence of missed earnings targets in previous periods on the R&D outlays in the current year remains unexplored. Prior research implied that managers are more sensitive to reported earnings when earnings missed their target in the previous year, and that such sensitivity might reduce discretionary investment spending to avoid missing a target in the current period (Barth *et al*., 1999; Demirag, 1998). Hence, this paper also explores whether missing an earnings target is related to reducing R&D expenditures to boost current period earnings.

H1: If firms missed earnings targets in previous periods, they are likely to cut R&D expenditures in subsequent periods.

2.3. *Earnings management through R&D and capital market valuation*

It is undetermined how capital markets perceive earnings that match earnings targets at the expense of unexpected reductions in R&D outlays. Previous research revealed that capital markets highly evaluate firms that beat / meet earnings targets. Conversely, firms that miss targets experience significant declines in stock prices (Bartov *et al*., 2002; Bernard *et al*., 1993; Skinner and Sloan, 2002). In addition, previous studies suggested that a positive relationship exists between firm values and the level of R&D or changes in R&D expenditures. Thus, capital markets perceive that R&D investments

[3] Managers also have incentive to decrease earnings downwards in some situation. For example, managers defer earnings to the following periods when the current earnings would be enough high to achieve targets because earnings are often smoothed and deferred earnings would be a part of earnings in the next periods.

are beneficial for competition among firms and that reducing R&D spending to achieve targets potentially decreases firm values. Moreover, valuations by capital markets are presumably lower for firms engaging in earnings management to achieve targets.

H2: If firms missed earnings targets in previous periods and intentionally reduced R&D expenditures in subsequent periods, capital markets place a low value on earnings management through R&D expenditures.

3. RESEARCH DESIGN

3.1. *Earnings targets*

This paper examines managers' behavior in terms of R&D investments when earnings missed targets and uses three types of target numbers.

The first earnings target is zero. Previous research such as Burgstahler and Dichev (1997)[4] insisted that managers are likely to avoid losses and that small profits are often reported because reporting losses decreases firms' market values. Therefore, an indicator variable $MISS\_ZERO_t$ is used, which is one if earnings in year t are less than zero and is zero otherwise. Burgstahler and Dichev (1997) documented that managers often avoid earnings decreases because stakeholders use heuristic cut-offs to evaluate firm performance, of which a criterion is the previous year's earnings. An indicator variable ($MISS\_LAST_t$) is employed, which is one if current earnings are less than previous earnings and is zero otherwise.

The last earnings threshold is an earnings forecast. For example, Degeorge *et al.* (1999) found a significant difference in subsequent market reaction between meeting and failing consensus earnings forecasts. Hence, I consider managers' earnings forecasts as a threshold. In this paper, I use not the first earnings forecasts but the latest earnings forecast numbers, which are released at the nearest to a fiscal end. Because managers often revise their earnings forecasts during fiscal periods, several earnings forecasts are available. However, I assume that the first earnings forecasts do not adequately reflect the influence of managers' intention because managers revise the

[4] Burgstahler and Dichev (1997) explained from two perspectives the motivation for earnings management to avoid earnings declines and losses. The first is transaction cost theory, which assumes that firms with higher earnings face lower costs in transactions with stakeholders. The other is prospect theory, which suggests that decision makers derive value from gains and losses with respect to a reference point rather than from absolute levels of wealth and that individuals' value functions are concave in gains and convex in losses.

level of earnings forecasts many times considering the cash flow generating process during the period and subsequently adjust earnings forecasts. I use an indicator variable $MISS\_FORECAST_t$, which is one if reported earnings in year *t* are lower than the latest earnings forecasts in year *t* and is zero otherwise.

3.2. *Earnings smoothing with R&D*

Managers might discretionally adjust their R&D budgets to smooth earnings numbers and close the gap between actual bottom line and market expectation. To exploit an association between managers' behavior in terms of R&D investments and exceeding earnings thresholds, the level of R&D expenses that management manipulates needs to be measured. Japanese firm managers voluntarily publish not only the forecast number but also forecast R&D number, which is considered quite unique disclosure system. Thus, this paper adopts a model that regards the level in managerial R&D forecast number as the normal R&D expenditure level. That is, the R&D budgets adjustment in year *t* ($RDBA_t$) are calculated by subtracting managerial R&D forecast from actual R&D expenses as follows,

$$RDBA_t = RD_t - FRD_t \quad (1)$$

where RD_t is actual total R&D expenditures and FRD_t is latest managerial forecast R&D expenditures. Because managements publish forecasts four times per year, implying that they revise their forecast three times, this paper utilizes the forecast numbers that are announced just before the fiscal end. If $RDBA_t$ is negative, it is likely that managers attempt to discretionarily decrease the amount of R&D expenditures in order to avoid that earnings fall short of any earnings targets. In this definition, I can regard this $RDBA_t$ as the unexpected R&D expenditures. $RDBA_t$ is deflated by the total assets in year t–1.

3.3. *Control variables*

To analyze the hypotheses, several control variables are used because previous studies discovered that several factors influence the level of earnings or R&D expenditures and market valuations. Firstly, I take into account the managerial revision of R&D forecast ($FRDREV_t$). As mentioned above, in this paper I utilize the managers' R&D forecasts

and these forecasts are revised three times per year. Firms that have missed earnings targets in the previous year might be so sensitive to the current earnings that managers in such firms would adjust the R&D budgets in the current fiscal year and contemporarily revise R&D forecasts to avoid market participants' huge surprises. Here, $FRDREV_t$ is defined as the difference between first R&D forecasts and last (fourth) R&D forecasts. In sum, shown in Figure 2, managerial R&D forecast revisions would be affected by whether firms achieve earnings targets in the last fiscal year and would have an impact on the current R&D budgets adjustment[5].

Next following Berger (1993) and Bushee (1998), changes in sales ($\Delta SALES_t$), capital expenditures ($\Delta CAPX_t$), and cash available for investments ($\Delta CASH_t$) as well as change in earnings before interests, taxes, depreciation and amortization (EBITDA) ($\Delta EBITDA_t$), are also controlled. $\Delta SALES_t$ is a proxy for a firm's growth, and growth firms are expected to be less likely to decrease R&D expenses. $\Delta CAPX_t$ measures the degrees of the investment opportunity and firms' maturity, and a negative value corresponds to a decline in investment opportunity and a more mature stage. $\Delta CASH_t$ and $\Delta EBITDA_t$ capture the funding constraints and increases in funds available for investments are expected to reduce the probability of decreasing R&D expenditures.

Also because Bange and De Bondt (1998) add annual trading volume (VOL_t), institutional shareholdings ($INST_{t-1}$), company risk (SE_{t-1}) and financial leverage (LEV_{t-1}), these variables are input in the regression models as control variables. VOL_t is a proxy for transient ownership and defined as the ratio of the average of daily trading volume in year *t* to the average number of share outstanding. The higher trading volume, the more information asymmetry arises. $INST_{t-1}$is a proxy for the dispersion of investors. The larger this ratio is, the less costly managements communicate with shareholders, implying that high institutional shareholdings decrease the possibility of earnings management. And business risk and cost of capital are related to the managerial earnings smoothing behavior (Lev and Kunitzky, 1974). In this paper, I utilize the standard error (SE_{t-1}) of the estimate for the market model regression as a proxy for the business risk. The estimation window for the market model is for the 60 months ending with fiscal ends of year $t-1$[6]. Financial leverage is a proxy for debt

[5] Almost all the Japanese firms' fiscal end is at the end of March and managerial R&D forecasts are published on January, April, July and October every year. This figure is illustrated based on firms whose fiscal end are March because this paper uses only firms whose fiscal end is March.

[6] The market return is returns of TOPIX, an equal-weighted index of all Tokyo stock exchange stocks.

capacity and controlled because firms' financial condition like financial distress has much to do with the managerial decision-makings (Opler and Titman, 1994). LEV_{t-1} is the ratio of total debts to total assets at the end of year $t-1$. Generally speaking, firms with high leverage are exposed to the more market pressure and are likely to engage in earnings management (Jensen, 1986).

The other control variables include logarithm of firm size ($SIZE_{t-1}$), book-to-market ratio (BM_{t-1}), R&D intensity (RDI_{t-1}), accounting accruals ($|ACC_t|$), and the median change in R&D expenditure ($\Delta INDRD_t$). According to Wiedman (1996), larger firms have a richer information environment, which constrains the opportunity to manage earnings. Regarding book-to-market ratio, Bushee (1998) insisted that high book-to-market ratio firms have growth opportunities; therefore, they encounter higher costs when reducing R&D expenditures. Financial leverage measures potential debt covenant incentives to manage earnings (Duke and Hunt, 1990). Higher financial leverage is assumed to increase the possibility for firms to reduce R&D outlays. Capital markets focus on firms whose R&D intensity is high with respect to managers' decisions to expense R&D (Barth *et al*., 2001). Hence, because capital markets more frequently monitor, high R&D-intensive firms, these firms are less likely to adjust their R&D expenditures. Accounting accruals are also controlled because they present an alternative method to manipulate earnings[7]. Finally, following Osma and Young (2009), the median change in R&D expenditure ($\Delta INDRD_t$) for each firms' industry is included to control for industry-wide shifts in R&D expenditures.[8]

3.4. *Panel regression models*

As previously noted, the association between missing earnings targets in a previous year and earnings management by reducing R&D expenditures is first examined. I examine this relationship using the following instrumental variables and two-stage least squares for panel-data model. As shown in Figure 2, the effects of R&D revision is controlled when the impact of missing earnings targets on the R&D budgets adjustment because R&D investment decision-makings are influenced by operating performance in the last yearIn the first stage regression, I regress R&D forecasts revision on variables that are

[7] Accounting accruals are calculated from cash flow statements. In sum, accounting accruals are defined by subtracting operating cash flow in year *t* from net incomes in year *t*.

[8] $FRDREV_t$, $\Delta SALES_t$, $\Delta CAPX_t$, $\Delta CASH_t$, $\Delta EBITDA_t$, LEV_{t-1}, RDI_{t-1} and $|ACC_t|$ are deflated by the total assets in year *t*–1. Also all variable are winsorized at the 1 percentile or 99 percentile values.

found to have effects on the forecasts revision, and year and industry dummy variables like equation (2-1). And in the second stage regression, i.e. in equation (2-2), R&D budgets adjustment is regressed on indicator variables for missed earnings targets in the previous year, managerial R&D forecast revision, control variables, and year and industry dummy variables. Here, industry classification is based on the classification by Tokyo stock exchange.

$$\begin{cases} FRDREV_t = \alpha_0 + \alpha_1 MISS\,VAR_{t-1} + \alpha_8 VOL_{t-1} + \alpha_9 INST_{t-1} + \alpha_{10} SE_{t-1} + \\ \alpha_{11} LEV_{t-1} + \alpha_{12} SIZE_{t-1} + \alpha_{13} BM_{t-1} + \alpha_{15} RDI_{t-1} + \alpha_{16} \Delta INDRD_{t-1} + \\ \sum YEAR\_DUMMY + \sum INDUSTRY\_DUMMY + \varepsilon_t \qquad (2\text{-}1) \\ \\ RDBA_t = \beta_0 + \beta_1 MISS\,VAR_{t-1} + \beta_2 FRDREV_t + \beta_3 MISS\,VAR_{t-1} \times FRDREV_t + \\ \beta_4 \Delta SALES_t + \beta_5 \Delta CAPX_t + \beta_6 \Delta CASH_t + \beta \Delta EBITDA_t + \beta_{11} LEV_{t-1} + \beta_{12} SIZE_{t-1} + \\ \beta_{13} BM_{t-1} + \beta_{14} |ACC_t| + \sum YEAR\_DUMMY + \sum INDUSTRY\_DUMMY + \varepsilon_t \quad (2\text{-}2) \end{cases}$$

Equation (2-1) and (2-2) is estimated by fixed effect model. And in equation (2-2), $MISS\_ZERO_{t-1}$, $MISS\_LAST_{t-1}$, and $MISS\_FORECAST_{t-1}$ are input as the independent variable ($MISS\,VAR_{t-1}$). And these coefficients are expected to be negative and statistically significant, implying that whether firms achieved or missed earnings targets influences the level of R&D investment in the current fiscal period.

Moreover, the influence of earnings management on market values is addressed through reductions in R&D investments using a modified model based on Ohlson (1995). In this model, market value is expressed using book value and net income. Net income is divided into earnings before R&D expenditures, normal R&D expenditures, and abnormal R&D expenditures. Moreover, the interaction terms for missing earnings targets and R&D expenditures are added. The detailed panel regression model is as follows.

$$\begin{aligned} P_t = \\ & \gamma_0 + \gamma_1 BPS_{t-1} + \gamma_2 UEPS_t + \gamma_3 RDBAPS_t + \gamma_4 MISS\,VAR_{t-1} + \gamma_5 FRDREVPS_t + \\ & \gamma_6 UEPS_t \times MISS\,VAR_{t-1} + \gamma_7 RDBAPS_t \times MISS\,VAR_{t-1} + \gamma_8 FRDREVPS_t \times \\ & MISS\,VAR_{t-1} + \sum YEAR\_DUMMY + \sum INDUSTRY\_DUMMY + \varepsilon_t \qquad (3) \end{aligned}$$

where P_t is price per share three months after the end of the fiscal year in year *t*, BPS_{t-1} is book value per share in year *t*, $UEPS_{t-1}$ is unmanaged earnings per share in year *t*, $RDBAPS_t$ is R&D budgets adjustment per share in year *t*, and $FRDREVPS_t$ is managerial R&D forecast revision per share in year *t*. Year dummy and Industry dummy variables are included in the estimation model and all the consecutive variables are scaled by P_{t-1} (price per share nine months before the fiscal year in year *t*). As is the case with equation (2), equation (3) is also regressed by fixed effect panel estimation. In equation (3), $MISS\_ZERO_{t-1}$, $MISS\_LAST_{t-1}$, and $MISS\_FORECAST_{t-1}$ are input in $MISS\,VAR_{t-1}$. Here it is expected that γ_3 and γ_7 are significantly positive when market participants think that earnings are manipulated by the R&D budgets adjustment because positive $RDBAPS_t$ presents the possibility that firms reduce R&D expenditures and adjust R&D budgets for income-increasing management.

4. DATA AND SAMPLE CHARACTERISTICS

4.1. *Sample*

The sample in this study consists of Japanese-listed companies with firm year from 2002 to 2006. Both financial and earnings forecast data were from NEEDS Financial Quest provided by Nikkei Digital Media Inc. Market data were collected from the NEEDS Portfolio Master given by the same company. R&D forecast data were hand-collected from *Kaisha-Shikiho* provided by *Toyo Keizai Shinposha*[9]. The following were requirements in the sample selection: (1) firms do not belong to the financial institution section, (2) the fiscal period is 12 months, (3) fiscal year-end is March, (4) shareholder equity does not take negative values, and (5) all data are available for analysis. Consequently, the final sample of observations contains 4,280 firm years.

Table 1 shows observation numbers as well as R&D intensity (R&D expenditures divided by lagged total assets) by calendar year and industry. Panel A shows the sample distribution by calendar year. Observations numbers for each year are almost 850 firm-years per year. Moreover, R&D intensities are distributed uniformly and are, on average, 2.403%. In contrast, Panel B provides a sample distribution by industry[10]. From Panel B, average R&D intensity (*RDI*) in the drug industry is 6.970%, the highest

[9] In these materials, managers' forecasts of capital expenditure and depreciation are also published.
[10] Industry classification is based on the Tokyo Stock Exchange Industry Classification, which is popular in Japan.

among all industries. The electric and electronic equipment and precision equipment industries are second and third highest, respectively. Firms within these industries must often spend significantly on R&D to obtain competitive advantages. Moreover, as a whole, *RDI* of manufacturing industries was revealed to be higher than that of non-manufacturing industries.

4.2. *Summary statistics*

Table 2 provides the descriptive statistics for the sample in this study. On average, $RDBA_t$ is –0.0007, which implies that the R&D budgets of approximately 0.07% of total assets are adjusted. In short, sample firms reduce actual R&D outlays by 0.07% of total assets relative to the managerial latest R&D forecasts. Table 2 also shows that approximately 22% of firms reported losses, approximately 41% experienced earnings decreases, and negative earnings surprises occurred in approximately 60% of firms, which is slightly high. This ratio is high although this paper uses the first managers' earnings forecast to set *MISS_FORECAST*. Considering that managers usually revise their earnings forecasts during their fiscal periods, this slightly high number might indicate that managers downgrade firms' earnings targets during such periods.

Moreover, Panels A and B of Table 3 present the correlation matrices. Panel A shows that $RDBA_t$ is negatively correlated with the indicator variables for missing or achieving earnings targets in previous periods ($MISS\_ZERO_{t-1}$, $MISS\_LAST_{t-1}$, $MISS\_FORECAST_{t-1}$). Therefore, firms are likely to decrease R&D expenses when they miss the earnings target for the previous year. In addition, from Panel B, $RDABPS_t$ is negatively correlated with P_t, whereas $UEPS_t$ is positively correlated with P_t. As indicated by several prior studies, this result suggests that unmanaged earnings are value-relevant but a part of earnings induced from R&D budgets adjustment do not increase firm values.

[Insert Table 2 about here]

[Insert Table 3 about here]

5. RESULTS

5.1. *Univariate tests of R&D budgets adjustment and missing earnings target in the previous year*

Table 4 provides the results of Whelch's *t*-test examining whether missing targets in the previous periods have any influence on the managerial decision-making in terms of R&D budgets and R&D forecast revisions. If $MISS\_ZERO_{t-1}$ is 1, earnings in the previous year is less than zero, otherwise more than zero. If $MISS\_LAST_{t-1}$ is 1, earnings in year *t*–1 is less than earnings in year *t*–2, otherwise earnings in year *t*–1 is over earnings in year *t*–2. And If $MISS\_FORECAST_{t-1}$ is 1, earnings in the previous year is less than the latest earnings forecasts, otherwise earnings beat or meet the latest forecast number. Here, whether the levels of $RDBA_t$ and $FRDREV_t$ are different between the group missing targets and the group beating / meeting targets.

Firstly, I confirm the results of $MISS\_ZERO_{t-1}$. If firms missed earnings targets, $RDBA_t$ is –0.0009 and $FRDREV_t$ is –0.004 on average. On the other hand, if firms achieve targets, the mean value of $RDBA_t$ is –0.0006 and of $FRDREV_t$ is –0.001. This implies that firms missing targets in the last periods are likely to reduce the reporting R&D outlays and revise R&D forecasts downward. And the statistical significance is confirmed in both $RDBA_t$ and $FRDREV_t$ between the missing group and the achieving group. In particular, the difference of $RDBA_t$ is –0.002 and *t*-value is –1.8769 (statistically 10% significant) and the difference of $FRDREV_t$ is –0.003 and *t*-value is –3.9481 (statistically 1% significant). This result indicates possibility that managers intentionally decrease R&D expenses to avoid consecutively missing targets and revise down R&D forecasts to keep R&D surprise below as possible when firms experienced negative earnings values in the last periods.

Next, with respect to $MISS\_LAST_{t-1}$, Table 4 shows similar findings to $MISS\_ZERO_{t-1}$. In the case earnings in year *t*–1 were fewer than that in year *t*–2, mean value of $RDBA_t$ is –0.0008 and of $FRDREV_t$ is –0.0003, while average $RDBA_t$ is –0.0006 and of $FRDREV_t$ is –0.0001 when firms achieved the previous years' earnings in the last year. Mean values of these two differ by –0.0002 in $RDBA_t$ and $FRDREV_t$, and these differences are statistically significant (*t*-values are –1.7352 and –3.1490, respectively). Such a result suggests that as with the case of $MISS\_ZERO_{t-1}$, managements place a special emphasis on the R&D budgets adjustment and R&D forecasts revision when firms could not achieve benchmark of earnings number in the just last periods.

Finally, I see the result of $MISS\_FORECAST_{t-1}$. In the group missing earnings forecast in the previous year, on average $RDBA_t$ is –0.0007 and $FRDREV_t$, is –0.0002.

Meanwhile, in the group achieving earnings forecast in the year t–1, $RDBA_t$ is –0.0007 and $FRDREV_t$, is –0.0002, too. Therefore it was found that there is no difference between these two groups in $RDBA_t$ and $FRDREV_t$. Also no statistical significance is confirmed in Table 4 since t-values are –0.1593 and –0.4605. This is interpreted as indicating that managers are not so sensitive to missing their own earnings forecast numbers.

Put it all together, the results in the univariate tests imply that manager might adjust R&D budgets and revise R&D forecasts when the earnings in year t–1 is less than zero or earnings in year t–2, while missing earnings forecasts in the previous periods have little to do with the managerial behavior and decision-making regarding R&D expenditures.

[Insert Table 4 about here]

5.2. *Effects of missing earnings targets in the previous year on R&D expenditures in the subsequent year*

Table 5 reports the estimated results of equations (2-2) and t-values are shown in the parentheses. Because firms that missed earnings targets in the previous year face significant pressure to avoid missing current earnings targets, indicator variables regarding missing earnings targets are considered to have a negative relationship with current R&D budgets adjustment. Hence, the coefficient β_1 in equation (2-2) is expected to be statistically negative. Table 5 shows that all coefficients for $MISS\_ZERO_{t-1}$, $MISS\_LAST_{t-1}$, and $MISS\_FORECAST_{t-1}$ are negative and statistically significant at the 1% level. For example, the coefficient for $MISS\_ZERO_{t-1}$ is −0.0006 (t-value = −2.51), the coefficient for $MISS\_LAST_{t-1}$ is −0.0006 (t-value = −2.04), and the coefficient for $MISS\_FORECAST_{t-1}$ is −0.0009 (t-value = −2.22). Therefore, hypothesis 1 in this paper is supported.

Besides, in all regression models, the coefficients on $FRDREV_t$ are statistically positive. Considering that positive $FRDREV_t$ indicates that R&D forecasts are upwardly revised, these firms might be willing to actively invest in R&D in prospect of the future growth potentiality. On the other hand, looking at results of the interaction terms of $FRDREV_t$ and indicator variables for missing earnings targets, all coefficient on interaction terms are statistically negative. This suggests that when managers revise

R&D forecasts upward in the current period even if firms could not achieve earnings targets in the previous periods, finally managers in such firms tend to eliminate R&D expenditures.

When the coefficient levels are compared, the coefficient on $MISS\_FORECAST_{t-1}$ is the smallest of the three, implying that managers have a strong incentive to reduce R&D expenditures when the last earnings missed zero rather than the previous earnings or earnings forecast. This is inconsistent with the results of univariate tests. In the univariate tests, no significant difference was found when $MISS\_FORECAST_{t-1}$ was focused. Given the comprehensive relationship between missing targets in the previous periods and R&D forecasts revision, and R&D budgets adjustment, it is confirms that missing targets (zero, last earnings and earnings forecasts) have much to do with managerial decision about R&D investment and R&D budgets plans.

[Insert Table 5 about here]

5.3. *Effects of abnormal R&D expenditures and missing earnings targets on market values*

Previous studies found the level of R&D expenditures to be positively related to market values because markets regard R&D investments as a source of firms' innovation and future growth opportunities, and investors favorably evaluate firms that spend significantly on R&D. However, that R&D budgets intentionally adjusted by managers to achieve earnings targets might not result in innovation because such adjustments are merely accounting manipulations. In addition, this study has shown an economic evidence that firms that missed earnings targets in previous periods are more likely to adjust R&D investments to achieve current earnings targets. Therefore, unexpected R&D expenditures in these firms may be less value-relevant.

Table 6 shows the results of the tests for hypothesis 2. This estimation model is based on the residual income model originally put forward by Ohlson (1995), which regresses market values on book values and net incomes (see Model (1) in Table 6). As a rule, The results in previous research using Ohlson model usually shows that coefficient on both BPS_t and EPS_t are significantly positive. From Model (1) in Table 6, it is confirmed that coefficient on BPS_t is 0.1289 (t-value is 15.35) and on EPS_t is

0.4333 (*t*-value is 11.26), consistent with the results of previous research. Thus, I could argue that data in this sample would be hard and unfailing.

In Model (2), EPS_t is divided into R&D budgets adjustment per share ($RDBAPS_t$) and unmanaged earnings without R&D budgets adjustment per share ($UEPS_t$). Model (2) shows that the coefficient on $RDBAPS_t$ (R&D budgets adjustment per shares) is significantly negative. This results suggests that R&D expenditures excessively invested than capital market participants would expect in advance are discounted, implying that capital market regards R&D expenditures as not a source of the future performance but just a kind of costs. While, it was found that $UEPS_t$ is statistically positive, implying that the larger unmanaged earnings are, the more highly market evaluate these firms.

Next, in Model (3) managerial R&D forecasts revision ($FRDREVPS_t$) is added into Model (2). $FRDREVPS_t$ was found to have significant negative effects on market values, which indicates that markets place low assessments on investments in R&D projects. Market would consider that these firms expanding R&D investment plans would not always reap the fruitful financial good outcomes and opportunities that initiate future growth.

From Model (4) to Model (6), interaction terms of unmanaged earnings, R&D budgets adjustment, and R&D forecasts revision and indicator variables for missing earnings targets were added. These results indicate that all coefficients on the interaction terms of the indicator variables are negative and statistically significant at the 1% level in Model (4) and (6). For example, in Model (4) the coefficient on $UEPS_t \times MISS\_ZERO_{t-1}$ is –0.4315 (*t*-value = –5.59), the coefficient on $RDBAPS_t \times MISS\_ZERO_{t-1}$ is –2.5611 (*t*-value = –2.98), and the coefficient on $FRDREVPS_t \times MISS\_ZERO_{t-1}$ is –4.5933 (*t*-value = –2.79). Furthermore, in Model (6) the coefficient on $UEPS_t \times MISS\_FORECAST_{t-1}$ is –0.4312 (*t*-value = –5.08), the coefficient on $RDBAPS_t \times MISS\_FORECAST_{t-1}$ is –2.0728 (*t*-value = –2.44), and the coefficient on $FRDREVPS_t \times MISS\_FORECAST_{t-1}$ is –3.1616 (*t*-value = –3.09).

In Model (4) and (6), the coefficients on interaction terms of $UEPS_t$ and indicator variables is negative and statistically significant, indicating that unmanaged earnings also discounted when firms could not achieve positive earnings or beat / meet earnings forecast in the previous periods. It would be pointed out that market judge such firms with strict and critical eyes. Next, looking at the interaction terms of $RDBAPS_t$ and indicator variables, the coefficients are also significantly negative. These results suggest

that investors don't favorably place any value on R&D budgets adjustments. In particular, investors more reduce estimates for firms when firms missed targets in the previous periods and engage in the income-decreasing manipulation in the following periods[11]. Finally, I confirm the results of interaction terms of $FRDREVPS_t$ and indicator variables. Significant negative coefficients suggests that R&D forecasts are revised upwardly even though firms missed earnings targets in year t–1, investors downgraded their assessments of these firms because it is highly possible that markets participants in Japanese capital market just consider R&D one components of costs.

[Insert Table 6 about here]

6. CONCLUDING REMARKS

This paper investigates the association between failure to beat or meet earnings targets and earnings management by reducing R&D investments. I examine whether Japanese firms reduced R&D spending in response to short-term earnings pressure. Particularly, I focus on the situation that managers have strong incentive to cut R&D expenses to achieve earnings targets. Concretely, I take particular note of the cases where firms missed three kinds of earnings targets in the previous periods; zero, last earnings, and earnings forecast. It is expected that firms adjust R&D budgets to avoid consecutively reporting earnings less than several targets. By examining this, I would like to address the specific situation where managers tend to utilize R&D investment planning in earnings management.

In addition, I focus on market valuations of firms that adjust R&D budgets to beat / meet earnings targets and address how capital market participants interpret such behavior because economic consequences are quite important. Notably, R&D investment are strongly related to the future growth opportunities, it is believed to be significant knowing that how investors perceive the R&D investment and earnings manipulation with R&D budgets adjustment.

In this paper, two hypotheses are empirically tested from 2002 to 2006 using a sample of R&D-active Japanese firms. And one characteristic in this paper is to take advantage of information from managers' R&D forecasts. Unlike in the case of other

[11] Conversely, it may be said that if firms use income-increasing R&D accounting treatments even if the earnings in the last year could not achieve targets numbers, firms make a favorable assessment of such firms.

countries, Japanese firms voluntarily publish R&D forecasts as well as earnings forecasts. Therefore I regard this R&D forecasts as normal R&D spending and define the R&D budgets adjustment as the difference between actual R&D expenditures and R&D forecasts. In addition, I also use R&D forecasts revision to more exactly capture the managerial behavior regarding R&D investment because R&D forecasts are revised three times per year.

From the univariate tests, it is addressed that firms are inclined to adjust R&D budgets to avoid consecutively missing targets when they experience the negative earnings or earnings decreases in the just last periods. Furthermore, from the results of instrumental variables panel-data estimation, R&D budgets have a tendency to be reduced if firms could not achieve earnings target (zero, last earnings, and earnings forecasts). These results from univariate tests and regression tests are consistent with the hypothesis in this paper. In short, R&D expenditures are found to be sensitive to lagged earnings performance relative to earnings targets. In particular, failure to beat / meet a managers' earnings forecast benchmark increases the R&D reductions in subsequent periods, implying that managers are pressured to avoid missing earnings targets for two consecutive terms.

After uncovering a relationship between managerial behaviors on R&D investments and earnings targets, I explore how investors in capital markets interpret earnings in the presence of unexpected R&D budgets adjustment. The results from panel-data regression estimation using the residual income model suggested that investors discount income-decreasing earnings management related to unexpected R&D budgets adjustment. Especially, investors place low assessments on firms with negative earnings in the previous periods or missing managers' earnings forecasts. These results are inconsistent with the expectation. Considering that R&D is greatly related to the innovation, which would create the future growth, R&D should be highly evaluated by market participants. However, the results in this paper shows that firms engaging in income-increasing management by cutting R&D expenditures are favorably evaluated in the capital market no matter whether firms missed earnings targets in the last periods. Thus, it could be pointed out that market do not necessarily promote far-sighted decision-making. To correctly know and reveal what is happening when investors take stock of firms' investment policies requires further investigation.

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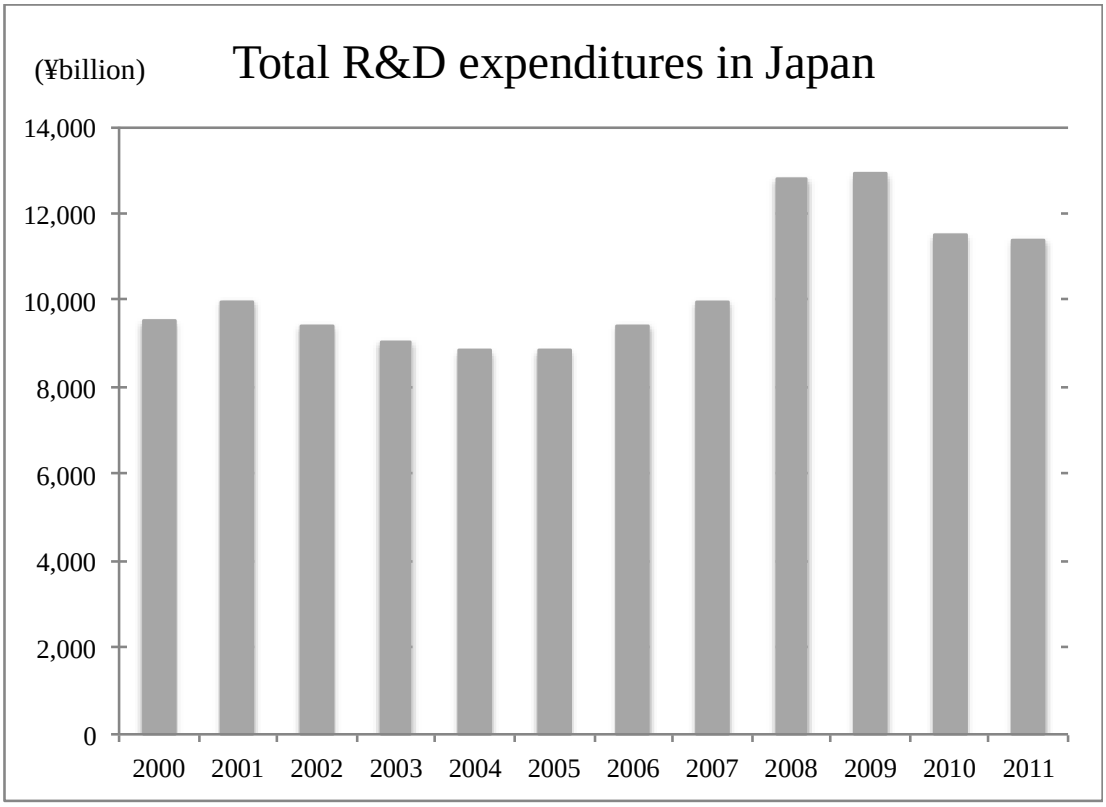
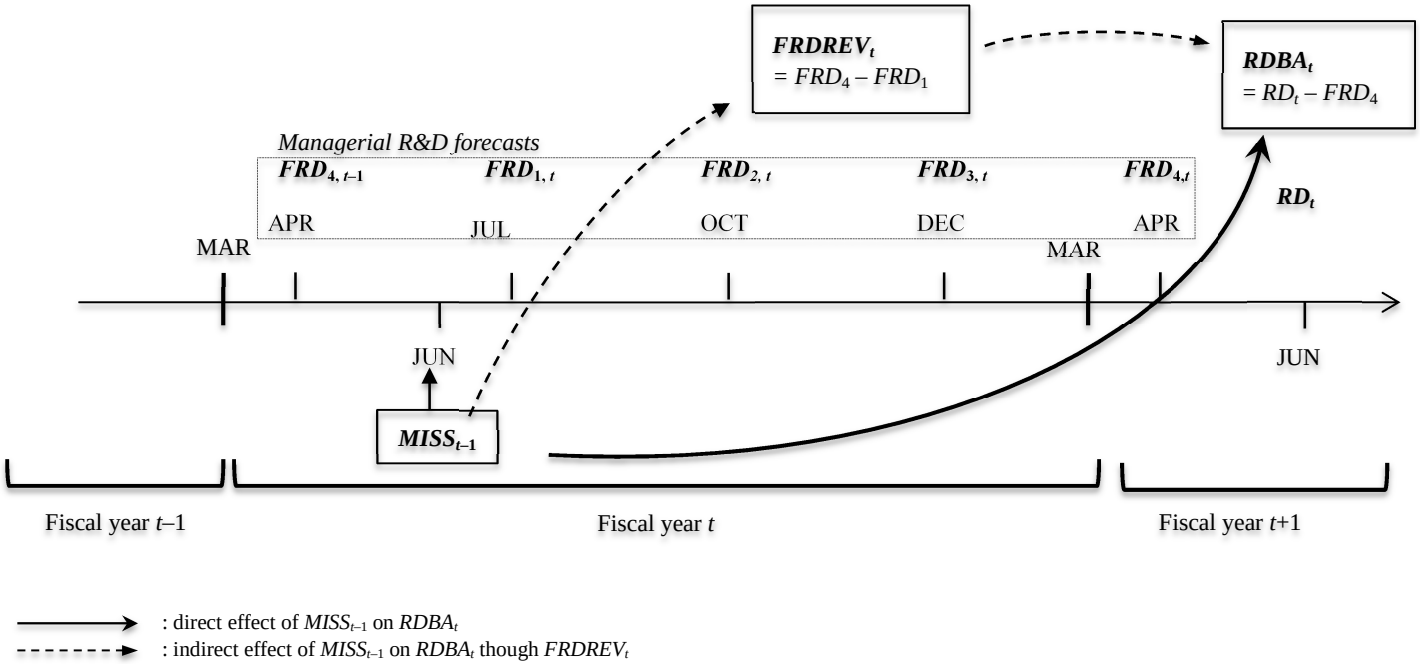
Figure 1 Total R&D expenditures by all the Japanese listed firms from 2000 to 2011



Note: Data were collected from NEEDS Financial Quest.

Figure 2 Relationship between missing earnings target in year *t*–1 and R&D budgets adjustment in year *t*



Note: $MISS_{t-1}$ shows whether firms missed earnings targets in year t–1, $FRDREV_t$ is managerial R&D forecast revision in year *t*, which is the difference between latest R&D forecasts and first R&D forecast, and $RDBA_t$ is R&D budgets adjustment in year *t*, which is the difference between actual R&D expenditures and managerial latest R&D forecasts. Shown in Figure 2, managers publish R&D forecast four times per year, i.e. on July, October, December and April. And official financial statements are often announced on June because fiscal end of all most all the Japanese is March.

Table 1 Sample distributions

Panel A: by calendar year

Year	*RDI*	*N*
2002	2.281%	830
2003	2.365%	865
2004	2.494%	860
2005	2.472%	863
2006	2.398%	862
All	2.403%	4,280

Note: *RDI* is R&D intensity, calculated as R&D expenditures divided by lagged total assets.

Panel B: by industry

Industry	*RDI*	*N*	Industry	*RDI*	*N*	Industry	*RDI*	*N*
Food	1.356%	263	Metal ware	1.231%	172	Retail Trade	0.270%	23
Textiles	1.522%	130	Machinery	1.926%	588	Trucking & Railroad	0.006%	3
Pulp & Paper	0.478%	56	Electric & Electronic Equipment	4.316%	727	Sea transportation	0.002%	3
Chemicals	2.667%	547	Motor Vehicles	3.101%	268	Air transportation	0.504%	9
Drugs	6.970%	162	Precision Equipment	3.800%	114	Warehousing & Harbor	0.269%	5
Petroleum	3.319%	8	Other Manufacturing	1.997%	171	Communication Services	2.237%	77
Rubber	2.447%	51	Fishery	0.409%	15	Electric & Gas	0.478%	17
Stone, Clay, & Glass	1.244%	142	Mining	0.762%	13	Services	1.908%	77
Iron & Steel	0.573%	95	Construction	0.364%	337	All	2.403%	4,280
Non-ferrous Metal	1.303%	91	Whole Trade	0.421%	116			

Note: *RDI* is R&D intensity, calculated as R&D expenditures divided by lagged total assets.

Table 2 Descriptive statistics

(N = 4,280)

	MEAN	SD	MIN	MEDIAN	MAX
$RDBA_t$	–0.0007	0.0040	–0.1919	–0.0003	0.0160
$MISS\_ZERO_{t-1}$	0.2199	0.4142	0.0000	0.0000	1.0000
$MISS\_LAST_{t-1}$	0.4124	0.4923	0.0000	0.0000	1.0000
$MISS\_FORECAST_{t-1}$	0.5951	0.4909	0.0000	1.0000	1.0000
$FRDREV_t$	–0.0002	0.0022	–0.0094	0.0000	0.0083
$\Delta SALES_t$	0.0194	0.1128	–0.3549	0.0169	0.4201
$\Delta CAPX_t$	0.0018	0.0231	–0.0809	0.0007	0.0887
$\Delta CASH_t$	0.0018	0.3878	–0.1151	–0.0005	0.1457
$\Delta EBITDA_t$	0.0810	0.0505	–0.0344	0.0750	0.2443
VOL_t	0.0015	0.0010	0.0001	0.0013	0.0049
$INST_{t-1}$	0.6458	0.1564	0.2446	0.6545	0.9251
SE_{t-1}	0.1134	0.0379	0.0459	0.1080	0.2514
LEV_{t-1}	0.5384	0.2051	0.1145	0.5488	0.9462
$SIZE_{t-1}$	10.2635	1.6371	7.0901	10.0921	14.4380
BM_{t-1}	0.1150	0.0687	0.0183	0.0998	0.3479
$\lvert ACC_t \rvert$	0.0476	0.0358	0.0009	0.0408	0.1838
RDI_{t-1}	0.0233	0.0228	0.0003	0.0162	0.1037
$\Delta INDRD_t$	0.0259	0.0766	–0.1366	0.0209	0.3104
P_t	1.1302	0.3729	0.4801	1.0657	2.6029
BPS_t	1.1632	0.6658	0.1735	1.0204	3.3566
EPS_t	0.0141	0.1313	–0.7377	0.0412	0.2292
$UEPS_t$	0.0115	0.1332	–0.7409	0.3954	0.2252
$RDBAPS_t$	–0.0024	0.0113	–0.0613	–0.0008	0.0342
$FRDREVPS_t$	–0.0006	0.0059	–0.0315	0.0000	0.0202

Note: Variable definitions are as follows. $RDBA_t$: R&D budgets adjustment in year t; $MISS\_ZERO_{t-1}$: indicator variable equal to one if earnings in year $t-1$ are less than zero and zero otherwise; $MISS\_LAST_{t-1}$: indicator variable equal to one if earnings in year $t-1$ are less than earnings in year $t-2$ and zero otherwise; $MISS\_FORECAST_{t-1}$: indicator variable equal to one if earnings in year $t-1$ are less than the earnings forecast and zero otherwise; $FRDREV_t$ is managerial R&D forecast revision in year t; $\Delta SALES_t$: change in sales from year $t-1$ to year t; $\Delta CAPX_t$: change in capital expenditures from year $t-1$ to year t; $\Delta CASH_t$: change in cash and cash equivalents from year $t-1$ to year t; $\Delta EBITDA_t$: change in EBITDA from year $t-1$ to year t; VOL_t: the ratio of annual trading volume to total share outstanding in year t; $INST_{t-1}$: institutional shareholdings ratio at the end of year $t-1$; SE_{t-1}: standard error from CAPM at the end of year $t-1$; LEV_{t-1}: financial leverage at the end of year $t-1$; $SIZE_{t-1}$: logarithm of market equities at the end of year t; BM_{t-1} book-to-market ratio at the end of year t-1; ACC_t accounting accruals at the end of year t; RDI_{t-1} R&D intensity at the end of year $t-1$; $\Delta INDRD_t$: change in median of industry average R&D intensity from year $t-1$ to year t; Pt: price per share three months after the end of the fiscal year in year t; $BPSt$: book value per share in year t; $EPSt$: earnings per share in year t; $UEPSt$: earnings before R&D budgets adjustment per share in year t; $RDBAPSt$: R&D budgets adjustment per share in year t; $FRDREVPSt$: revision of R&D forecast per share in year t.

Table 3 Correlation matrices

Panel A: Correlation matrix for variables testing hypothesis 1

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1)	$RDBA_t$		–0.0508	–0.0517	–0.0133	0.0130	0.0582	0.0352	–0.0126	0.0339	–0.0388	0.0128	–0.0267	–0.0102	0.0366	–0.0126	0.0303	–0.0777	0.0044
(2)	$MISS\_ZERO_{t-1}$	–0.0292		0.4007	0.3239	–0.0690	–0.1530	–0.1256	–0.0436	–0.3750	0.0640	–0.1267	0.1781	0.2492	–0.2270	0.1543	0.0824	–0.0881	0.0637
(3)	$MISS\_LAST_{t-1}$	–0.0268	0.4007		0.3167	–0.0452	–0.1399	–0.1378	–0.0149	–0.2205	–0.0493	–0.0501	0.0350	0.0227	–0.1281	0.1662	0.075	–0.0619	0.0667
(4)	$MISS\_FORECAST_{t-1}$	–0.0024	0.3239	0.3167		–0.0165	–0.1584	–0.1450	–0.0262	–0.2738	–0.0251	–0.0657	0.0459	0.0835	–0.1568	0.1773	0.0666	–0.0560	0.1031
(5)	$FRDREV_t$	–0.0329	–0.0614	–0.0490	–0.0071		0.0857	0.0712	–0.0112	0.0721	–0.0482	–0.0270	–0.0429	–0.0312	–0.0157	0.0001	–0.0140	–0.0360	0.0038
(6)	$\Delta SALES_t$	0.0362	–0.1315	–0.1086	–0.1357	0.0089		0.2317	0.1564	0.4931	0.0334	0.1101	–0.0451	–0.1089	0.2074	–0.2076	–0.0114	0.1208	–0.0272
(7)	$\Delta CAPX_t$	0.0076	–0.0832	–0.1128	–0.1143	0.0662	0.2113		–0.0291	0.2063	–0.0060	0.0495	–0.0549	–0.0355	0.0592	–0.1029	–0.0534	0.0468	–0.0476
(8)	$\Delta CASH_t$	0.0052	–0.0438	–0.0201	–0.0258	0.0078	0.1371	–0.0245		0.1950	0.0156	0.0299	0.0211	–0.1005	0.0737	–0.0842	0.1764	0.0675	0.0064
(9)	$\Delta EBITDA_t$	0.0292	–0.3521	–0.2228	–0.2751	0.0564	0.4620	0.1912	0.1976		0.0174	0.2578	–0.1050	–0.3128	0.4160	–0.4362	0.0848	0.3471	–0.0302
(10)	VOL_t	–0.0041	0.0679	–0.0439	–0.0337	–0.0188	0.0029	0.0031	0.0180	0.0045		0.0418	0.3309	0.2119	0.3331	–0.3599	0.0494	0.1220	0.0103
(11)	$INST_{t-1}$	0.0172	–0.1239	–0.0483	–0.0624	–0.0210	0.0802	0.0405	0.0141	0.2511	0.0074		–0.1344	–0.0521	0.5599	–0.2733	0.0851	0.2429	–0.0184
(12)	SE_{t-1}	–0.0154	0.1609	0.0316	0.0462	–0.0314	–0.0336	–0.0455	0.0551	–0.0742	0.3262	–0.1564		0.2729	–0.1316	–0.1814	0.0955	–0.0002	0.0059
(13)	LEV_{t-1}	–0.0101	0.2518	0.0212	0.0814	–0.0181	–0.0915	–0.0298	–0.0984	–0.3098	0.2364	–0.0285	0.2512		–0.1903	–0.1501	0.0771	–0.1808	–0.0033
(14)	$SIZE_{t-1}$	0.0560	–0.2219	–0.1220	–0.1505	–0.0050	0.1575	0.0360	0.0632	0.4074	0.2568	0.5552	–0.1481	–0.1830		–0.5466	0.0199	0.3753	–0.0310
(15)	BM_{t-1}	–0.0411	0.1830	0.1619	0.1749	0.0021	–0.1589	–0.0800	–0.0825	–0.4114	–0.3202	–0.2353	–0.1347	–0.1294	–0.5250		–0.0419	–0.3555	0.0398
(16)	$\lvert ACC_t \rvert$	0.0299	0.1067	0.0911	0.0728	–0.0180	–0.0327	–0.0320	0.1627	0.0143	0.0652	0.0519	0.1390	0.0869	–0.0029	–0.0191		0.1262	0.0206
(17)	RDI_{t-1}	–0.0084	–0.0801	–0.0439	–0.0509	–0.0524	0.0637	0.0192	0.0439	0.2908	0.0689	0.2341	–0.0076	–0.1676	0.3866	–0.3182	0.1043		–0.0044
(18)	$\Delta INDRD_t$	0.0015	0.0456	0.0600	0.0744	0.0140	–0.0110	–0.0239	0.0012	–0.0267	0.0043	–0.0066	0.0140	0.0050	–0.0277	0.0420	0.0107	–0.0609	

Note:

1) Panel A shows correlation coefficients among the variables to test hypothesis 1. The lower left section provides Pearson's correlation coefficients and the upper right section provides Spearman's correlation coefficients.

2) Variable definitions are as follows. $RDBA_t$: R&D budgets adjustment in year t; $MISS\_ZERO_{t-1}$: indicator variable equal to one if earnings in year $t-1$ are less than zero and zero otherwise; $MISS\_LAST_{t-1}$: indicator variable equal to one if earnings in year $t-1$ are less than earnings in year $t-2$ and zero otherwise; $MISS\_FORECAST_{t-1}$: indicator variable equal to one if earnings in year $t-1$ are less than the earnings forecast and zero otherwise; $FRDREV_t$ is managerial R&D forecast revision in year t; $\Delta SALES_t$: change in sales from year $t-1$ to year t; $\Delta CAPX_t$: change in capital expenditures from year $t-1$ to year t; $\Delta CASH_t$: change in cash and cash equivalents from year $t-1$ to year t; $\Delta EBITDA_t$: change in EBITDA from year $t-1$ to year t; VOL_t: the ratio of annual trading volume to total share outstanding in year t; $INST_{t-1}$: institutional shareholdings ratio at the end of year $t-1$; SE_{t-1}: standard error from CAPM at the end of year $t-1$; LEV_{t-1}: financial leverage at the end of year $t-1$; $SIZE_{t-1}$: logarithm of market equities at the end of year t; BM_{t-1} book-to-market ratio at the end of year $t-1$; ACC_t accounting accruals at the end of year t; RDI_{t-1} R&D intensity at the end of year $t-1$; $\Delta INDRD_t$: change in median of industry average R&D intensity from year $t-1$ to year t.

Panel B: Correlation matrix for variables testing hypothesis 2

		(1)	(2)	(3)	(4)	(5)
(1)	P_t					
(2)	BPS_t	0.1980				
(3)	EPS_t	0.2265	–0.0521			
(4)	$UEPS_t$	0.2136	–0.0658	0.9869		
(5)	$RDBAPS_t$	–0.0659	–0.1077	0.0675	0.1891	
(6)	$FRDREVPS_t$	–0.0188	–0.0293	0.0879	0.0837	0.0060

Note:

1) Panel B shows Pearson's correlation coefficients among the variables in hypothesis 2.

2) Variable definitions are as follows. P_t: price per share three months after the end of the fiscal year in year t; BPS_t book value per share in year t; EPS_t: earnings per share in year t; $UEPS_t$: unmanaged earnings before R&D budgets adjustment per share in year t; $RDBAPS_t$: R&D budgets adjustment per share in year t; $FRDREVPS_t$: revision of R&D forecast per share in year t.

Table 4 Univariate tests by missing or beating / meeting targets in year *t*–1

	$MISS\_ZERO_{t-1} = 0$ (N = 3,339)	$MISS\_ZERO_{t-1} = 1$ (N = 941)	Difference	*t*-values
$RDBA_t$	–0.0006	–0.0009	–0.0002	–1.8769*
$FRDREV_t$	–0.0001	–0.0004	–0.0003	–3.9481***
	$MISS\_LAST_{t-1} = 0$ (N = 2,585)	$MISS\_LAST_{t-1} = 1$ (N = 1,695)	Difference	*t*-values
$RDBA_t$	–0.0006	–0.0008	–0.0002	–1.7352*
$FRDREV_t$	–0.0001	–0.0003	–0.0002	–3.1490***
	$MISS\_FORECAST_{t-1} = 0$ (N = 1,994)	$MISS\_FORECAST_{t-1} = 1$ (N = 2,286)	Difference	*t*-values
$RDBA_t$	–0.0007	–0.0007	–0.0000	–0.1593
$FRDREV_t$	–0.0002	–0.0002	–0.0000	–0.4605

Notes:

1) Variable definitions are as follows. $RDBA_t$: R&D budgets adjustment in year *t*; $FRDREV_t$ is managerial R&D forecast revision in year *t*; *MISS_ZERO*$t-1$: indicator variable equal to one if earnings in year $t-1$ are less than zero and zero otherwise; *MISS_LAST*$t-1$: indicator variable equal to one if earnings in year $t-1$ are less than earnings in year $t-2$ and zero otherwise; *MISS_FORECAST*$t-1$: indicator variable equal to one if earnings in year $t-1$ are less than the earnings forecast and zero otherwise.
2) *** and * denote 1% and 10% statistical significance, respectively.
3) Welch's *t*-test is used to obtain *t*-values.

Table 5 Effects of missing earnings targets in the previous year on R&D budgets adjustment in the subsequent year

Results of second-stage of instrumental variables panel-data regression (N = 4,280)

	Dependent variable: $RDBA_t$		
	Model (1)	Model (2)	Model (3)
$MISS\_ZERO_{t-1}$	–0.0006 ***		
	(−2.51)		
$MISS\_LAST_{t-1}$		–0.0006 **	
		(−2.04)	
$MISS\_FORECAST_{t-1}$			–0.0009 **
			(−2.22)
$FRDREV_t$	1.9659 ***	3.4447 **	3.7939 ***
	(2.97)	(2.30)	(2.66)
$MISS\_ZERO_{t-1}$	–2.1076 ***		
$\times FRDREV_t$	(–3.22)		
$MISS\_LAST_{t-1}$		–3.4341 **	
$\times FRDREV_t$		(–2.35)	
$MISS\_FORECAST_{t-1}$			–3.8643 ***
$\times FRDREV_t$			(–2.74)
$\Delta SALES_t$	–0.0020	–0.0015	–0.0019
	(–1.64)	(–1.03)	(–1.28)
$\Delta CAPX_t$	−0.0038	−0.0124	−0.0106
	(–0.98)	(–1.65) *	(–1.64)
$\Delta CASH_t$	0.0014	0.0010	–0.0001
	(0.62)	(0.33)	(–0.05)
$\Delta EBITDA_t$	–0.0039	–0.0048	–0.0043
	(–1.30)	(–1.21)	(–1.09)
LEV_{t-1}	–0.0039	–0.0006	–0.0013
	(–1.30)	(–0.67)	(–1.37)
$SIZE_{t-1}$	0.0001	0.0001	0.0001
	(1.18)	(1.15)	(0.64)
BM_{t-1}	–0.0030	–0.0030	–0.0023
	(–1.43)	(–1.16)	(–0.88)
$\lvert ACC_t \rvert$	0.0049	0.0068 **	0.0064 *
	(1.97)	(2.01)	(1.95)
Constant	−0.0007	−0.0009	0.0003
	(−0.56)	(−0.54)	(0.18)
ρ	0.3851	0.3075	0.3069
Year dummy	yes	yes	yes
Industry dummy	yes	yes	yes

Notes:

1) Variable definitions are as follows. $RDBA_t$: R&D budgets adjustment in year t; $MISS\_ZERO_{t-1}$: indicator variable equal to one if earnings in year t−1 are less than zero and zero otherwise; $MISS\_LAST_{t-1}$: indicator variable equal to one if earnings in year t−1 are less than earnings in year t–2 and zero otherwise; $MISS\_FORECAST_{t-1}$: indicator variable equal to one if earnings in year t−1 are less than the earnings forecast and zero otherwise; $FRDREV_t$ is managerial R&D forecast revision in year t; $\Delta SALES_t$: change in sales from year t−1 to year t; $\Delta CAPX_t$: change in capital expenditures from year t−1 to year t; $\Delta CASH_t$: change in cash and cash equivalents from year t−1 to year t; $\Delta EBITDA_t$: change in EBITDA from year t−1 to year t; LEV_{t-1}: financial leverage at the end of year t–1; $SIZE_{t-1}$: logarithm of market equities at the end of year t; BM_{t-1} book-to-market ratio at the end of year t-1; ACC_t accounting accruals at the end of year t.
2) ***, **, and * denote 1%, 5%, and 10% statistical significance, respectively.
3) All panel data regression models include year dummy and industry dummy variables.
4) Numbers in the parentheses are t-values.

Table 6 Effects of R&D budgets adjustment and missing earnings targets on market values

(N = 4,280)

	Dependent variable: P_t					
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
BPS_t	0.1289 ***	0.1246 ***	0.1235 ***	0.1193 ***	0.1232 ***	0.1205 ***
	(15.35)	(14.82)	(14.70)	(14.41)	(14.69)	(14.56)
EPS_t	0.4333 ***					
	(11.26)					
$UEPS_t$		0.4374 ***	0.4463 ***	0.7126 ***	0.4817 ***	0.7740 ***
		(11.37)	(11.59)	(11.99)	(8.54)	(10.44)
$RDBAPS_t$		–2.6667 ***	–2.7152 ***	–1.8681 ***	–3.1584 ***	–1.5856 ***
		(–5.98)	(–6.09)	(–3.33)	(–5.22)	(–2.35)
$FRDREVPS_t$			–2.8198 ***	–1.1256	–3.5377 ***	–1.5856 ***
			(–3.44)	(–1.08)	(–3.04)	(–2.35)
$UEPS_t$				–0.4315 ***		
$\times MISS\_ZERO_{t-1}$				(–5.59)		
$RDBAPS_t$				–2.5611 ***		
$\times MISS\_ZERO_{t-1}$				(–2.98)		
$FRDREVPS_t$				–4.5933 ***		
$\times MISS\_ZERO_{t-1}$				(–2.79)		
$UEPS_t$					–0.0651	
$\times MISS\_LAST_{t-1}$					(–0.88)	
$RDBAPS_t$					0.8577	
$\times MISS\_LAST_{t-1}$					(1.03)	
$FRDREVPS_t$					1.3324	
$\times MISS\_LAST_{t-1}$					(0.82)	
$UEPS_t$						–0.4312 ***
$\times MISS\_FORECAST_{t-1}$						(–5.08)
$RDBAPS_t$						–2.0728 ***
$\times MISS\_FORECAST_{t-1}$						(–2.44)
$FRDREVPS_t$						–3.1616 ***
$\times MISS\_FORECAST_{t-1}$						(–3.09)
Constant	0.9788 ***	0.9848 ***	0.9845 ***	0.7398 ***	0.0572 ***	0.9773 ***
	(24.97)	(25.21)	(25.23)	(25.35)	(25.22)	(25.29)
ρ	0.0618	0.0593	0.0593	0.0516	0.0571	0.0502
Year dummy	yes	yes	yes	yes	yes	yes
Industry dummy	yes	yes	yes	yes	yes	yes

Notes:

1) Definitions of variables are as follows. P_t: price per share three months after the end of the fiscal year in year t; BPS_t: book value per share in year t; EPS_t: earnings per share in year t; $UEPS_t$: unmanaged earnings before R&D budgets adjustment per share in year t; $RDBAPS_t$: R&D budgets adjustment per share in year t; $FRDREVPS_t$: revision of R&D forecast per share in year t; $MISS\_ZERO_{t-1}$: indicator variable equal to one if earnings in year $t-1$ are less than zero and zero otherwise; $MISS\_LAST_{t-1}$: indicator variable equal to one if earnings in year $t-1$ are less than earnings in year $t-2$ and zero otherwise; $MISS\_FORECAST_{t-1}$: indicator variable equal to one if earnings in year $t-1$ are less than the forecasted earnings and zero otherwise.
2) *** denotes 1% statistical significance.
3) All panel data regression models include year dummy and industry dummy variables.
4) Numbers in the parentheses are t-values.