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使用選擇權價格所隱含之非預期股利變動檢定自由現金流量及訊息傳遞假說：經常性股利增加之情況

An Examination of the Free Cash Flow and Information/Signaling Hypotheses Using Unexpected Dividend Changes Inferred from Option Prices: The Case of Regular Dividend Increases

傅 桂 欽

Kuei-Chin Fu

指 導 教 授：陳 聖 賢 博 士

Advisor: Sheng-Syan Chen, Ph.D.

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本論文係傅桂欽 (d92723003）在國立臺灣大學財務金融學系完成之博士學位論文，於民國 100 年 4 月 16 日承下列考試委員審查通過及口試及格，特此證明

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中文摘要

本篇論文使用 Bar-Yosef/Sarig 的方法，利用選擇權的價格，計算出非預期股利變動，以檢定自由現金流量假說及訊息傳遞假說。本文的實證結果發現:(1)股利宣告日期間的超額報酬與非預期股利變動有明顯的正向關係；(2)對低 Tobin q 廠商言，宣告日期間的超額報酬與其擁有的現金水準呈明顯的正向關係；(3)宣告日期間的超額報酬與現金水準的正向關係，低 Tobin q 廠商較高 Tobin q 廠商有較高的水準；(4)低 Tobin q 廠商在股利宣告日後的第四年，其資本支出及研究發展費用的水準較股利宣告日那一年的水準有降低現象。本文的實證結果支持自由現金流量假說。

關鍵字：自由現金流量假說、訊息傳遞假說、經常性股利、非預期股利變動。

Abstract

This paper adopts the Bar-Yosef/Sarig method to measure unexpected dividend changes in testing the free cash flow and information/signaling hypotheses. The empirical findings reveal the following: (1) Announcement period abnormal returns are positively related to unexpected dividend changes. (2) The association between announcement period abnormal returns and the cash level is significantly positive for low q firms. (3) The positive association between announcement period abnormal returns and the cash level is stronger in low q than in high q firms for most regressions. (4) Low q firms reduce their capital and research and development (R&D) expenditures during the four fiscal years following dividend increase announcements. Our findings are consistent with the free cash flow hypothesis.

Keywords: free cash flow hypothesis, information/signaling hypothesis, regular dividend, unexpected dividend changes.

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1. Introduction

What information is conveyed to the market when firms announce regular dividend increases? There are two main hypotheses that may be used to explain the phenomenon wherein a change in dividend affects value of a firm: the free cash flow hypothesis and the information/signaling hypothesis.[1] However, empirical results involving the two hypotheses are mixed.

This study reexamines the free cash flow and the information/signaling hypotheses in the context of regular dividend increases. Our article notes that regular dividend increases have a significant characteristic that differs from those of other event, studies on which have provided evidence supporting the free cash flow hypothesis.[2] Other studies deal with events that are either less anticipated or is unexpected by investors. In the case of regular dividend increases, on the contrary, there is a strong chance that investors expect the dividends to be distributed in the next quarter. If the announcement of dividend change is expected by investors, the abnormal returns generated during the announcement produce different effects. They reflect the investors' assessment of the actual dividend change—whether it is higher

[1] Although the free cash flow hypothesis and information/signaling hypotheses are not mutually exclusive, the flexibility hypothesis is mutually exclusive to the free cash hypothesis. When firms have free cash flow issue, which is caused by permanent components of cash flows, paying dividends is a useful method to solve the problem because dividends have sticky characteristics.

[2] See Yoon and Starks (1995).

or lower than what was anticipated. Since market's reaction is relative, not absolute, the announcement of a dividend increase may elicit a negative response if the actual dividend falls short of expectations (Harford, 1999). Previous studies, based on the naïve model, define unexpected dividend change as the proportional change in dividends from the previous quarter exceeding 10%.[3] Even so, their data contain some effects expected by investors, thereby affecting the validity of results of the test of the free cash flow hypothesis. Similarly, in testing whether dividend changes signal changes in future profitability, prior studies, such as those of Nissim and Ziv (2001) and Grullon et al. (2005), define annual dividend change as the annualized rate of quarterly dividend changes and use it as an explanatory variable in analyzing its impact on unexpected changes in earnings. The weakness in this definition is that annualized dividend change may not be a suitable proxy variable for unexpected dividend changes in explaining the variation of unexpected changes in earnings.

In measuring unexpected dividend changes, Bar-Yosef and Sarig (1992) show that dividend surprises (i.e., not normalized unexpected dividend changes) calculated from the price-based model are more suitable for measuring the unexpected component of dividend announcements than those used in prior studies, such as the naïve, Linter, Box-Jenkins, and analysts' dividend forecast methods. In order to use a

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[3] See Lang and Litzenberger (1989); Denis, Denis, and Sarin (1994); Yoon and Starks (1995); and Lie (2000).

more suitable proxy variable for unexpected dividend changes in testing the free cash and information/signaling hypotheses, our paper adopts the approach suggested by Bar-Yosef and Sarig (1992) to measure unexpected dividend changes.

According to the predictions of the free cash flow hypothesis, announcement period abnormal returns should be positively correlated with excess funds. Furthermore, this association is stronger in low q than in high q firms[4] if no other factor affects the relation between the announcement period abnormal returns and excess funds for high q firms.[5] Prior studies examine the relation between announcement period abnormal returns and excess funds in testing the free cash flow hypothesis. Denis, Denis, and Sarin (1994) find that the coefficients of the cash flow and the interaction term equal to the product of high q and cash flow are statistically insignificant. Using samples of special dividends, regular dividend increases, and self-tender offers, Lie (2000) examines the excess funds (the free cash flow) hypothesis, finding that the announcement period abnormal returns are uncorrelated with cash flow for all samples. However, the announcement period abnormal returns are positively related to cash level for large special dividends and self-tender offers, but not for regular dividend increases. Lie (2000) suggests that self-tender offers and

[4] Low q firms are those firms with overinvestment problem. By contrast, high q firms are those firms that have no overinvestment problem.

[5] When other factors affect the relation between announcement period abnormal returns and excess funds for high q firms, the differences between the two in low q firms and in high q firms may be insignificant, even if the free cash flow hypothesis holds.

large special dividends reduce agency problems associated with cash levels.

Using unexpected dividend changes extracted from the price model as a controlling variable in the regression of announcement period abnormal returns, we find that announcement period abnormal returns are positively related to unexpected dividend changes, and although announcement period abnormal returns are still uncorrelated with cash flow, the association between announcement period abnormal returns and cash level is significantly positive for low q firms. Besides, this association is stronger in low q than in high q firms for most regressions. Therefore, stock price reactions to dividend increase announcements convey a positive message for firms with low q and a higher cash level. This is a finding that differs from Lie's (2000) results in regular dividend increase cases for the following reasons: (1) We use a more suitable proxy variable for unexpected dividend changes as a controlling variable, and (2) our sample firms are those with options. In contrast, Lie's (2000) sample includes firms with no options. Firms with options are probably more mature and noticeable. Thus, the market reflects changes in the investment policies of managers to increases in dividends.

In addition, according to the predictions of the free cash flow hypothesis, low q firms will decrease capital expenditures following dividend increases. Previous studies such as those of Denis, Denis, and Sarin (1994) and Yoon and Starks (1995) find no evidence for this phenomenon, while Grullon, Michaely, and Swaminathan (2002) show that dividend-increasing firms do not increase their expenditure. Our empirical results indicate that low q firms reduce their capital expenditures and research and development (R&D) expenses during the four fiscal years following dividend increase announcements. R&D expenses are possibly more flexible for accommodating changes in investment policy. In sum, our findings are consistent with the free cash flow hypothesis.

In contrast, according to the predictions of the information/signaling hypothesis, changes in future earnings should be positively related to unexpected dividend changes. We find that when earnings before extraordinary items are used as a performance measure, dividend increases with positive unexpected dividend changes convey information about increases in future earnings. However, when operating income before depreciation is used as a performance measure, dividend increases with positive unexpected dividend changes provide very limited information about future changes. Using different performance measures, we obtain different empirical results; thus, we have no definite evidence supporting the information/signaling hypothesis. Although the free cash flow and information/signaling hypotheses are not mutually exclusive, we find more evidence supporting the free cash flow hypothesis.

The remainder of the paper proceeds as follows: an overview of the hypotheses and past studies (Section 2); an explanation of the methodology (Section 3); a description of the selection of the sample and the sample itself (Section 4); the empirical results of the free cash flow hypothesis (Section 5); the empirical results of the information/signaling hypothesis (Section 6); robustness checks (Section 7); and summary and conclusion (Section 8).

2. Hypotheses and Literature Review

2.1. *Hypotheses*

It is well documented that announcements of changes in dividends affect value of a firm.[6] But why do dividend changes affect value of a firm? The primary concern is what information is being conveyed to the market when announcements of changes in dividends are made. There are two main hypotheses explaining this phenomenon: the free cash flow and the information/signaling hypotheses.

2.1.1. The free cash flow hypothesis

Jensen (1986) argues that corporate managers are the agents of shareholders, but interests of corporate managers are not completely aligned with those of shareholders. A manager may expect to gain incentives if he invests resources of a firm in negative net present value (NPV) investment plan rather than distribute them to shareholders. When a firm with substantial free cash flow faces poor investment opportunities, the

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[6] For earlier studies, see Petit (1972), Aharony and Swary (1980), Asquith and Mullins (1983), Kalay and Loewenstein (1985), and Bajaj and Vijh (1990).

problem of overinvestment may be severe. The reason is that mangers can boost their power and compensation by expanding a firm's growth. Thus, if a low q firm associated with high cash flow announces a dividend increase, shareholders expect the level of overinvestment to decline. Similarly, a dividend decrease prompts shareholders to expect the level of overinvestment to increase, thereby reducing the firm's value.

Thus, in the case of regular dividend increases, the free cash flow hypothesis has some predictions that can be tested empirically. First, the announcement period abnormal returns should be positively related to excess funds for low q firms. Second, there is no relation between the announcement period abnormal returns and excess funds for high q firms, ceteris paribus. Finally, low q firms will decrease capital expenditures and research and development (R&D) expenses following dividend increase announcements.

2.1.2. The information/signaling hypothesis

When markets are incomplete, changes in dividends can convey information to the markets about future earnings if expectations of future earnings by managers affect their decisions about dividends. This assertion by Miller and Modigliani (1996) has been labeled as "the information content of dividends." There are two meanings to the information content of dividends: (i) managers just use dividends to convey information and (ii) dividends are used as a signal of future earnings. Afterwards, Bhattacharya (1979), Miller and Rock (1985), and John and Williams (1985) develop signaling models. They argue that since managers possess more information about future earnings of firms than investors outside the firms do, the managers have incentives to use dividend changes as a costal signal to change market perceptions concerning future earnings. The information/signaling hypothesis also have some predictions that can be tested empirically. A rise in dividends signals that the firm will have better earnings than the levels earlier projected by the market. On the other hand, a decrease in dividends means that the firm will have fewer earnings than the levels expected by investors. Moreover, under the information/signaling hypothesis, announcements of dividend increases are accompanied by positive abnormal stock returns.

2.2. *Literature review*

2.2.1. The free cash flow hypothesis

Previous papers in testing the free cash flow hypothesis are those by Lang and Litzenberger (1989), Denis, Denis, and Sarin (1994), Yoon and Starks (1995), and Lie (2000). Lang and Litzenberger (1989) argue that empirical results of their study support the free cash flow hypothesis over the cash flow signaling hypothesis.

Denis, Denis, and Sarin (1994), and Yoon and Starks (1995) use regression to test the free cash flow hypothesis controlling for dividend yield, size of firm, and magnitude of the dividend change. Yoon and Starks (1995) find that their regression results are not consistent with the predictions of the free cash flow hypothesis. After analyzing revisions of analysts' forecasts on earnings and changes in capital expenditures, Yoon and Starks (1995) claim that their empirical results are consistent with the cash flow signaling hypothesis rather than the free cash flow hypothesis. Denis, Denis, and Sarin (1994) find that the coefficients of the cash flow and the interaction term equal to the product of high q and cash flows are statistically insignificant, and that low q firms increase their capital expenditure following dividend increases. They point out that their findings provide little support to the free cash flow hypothesis.

Finally, using samples of special dividends, regular dividend increases, and self-tender offers, Lie (2000) examines the excess funds (the free cash flow) hypothesis, finding that announcement period abnormal returns are uncorrelated with cash flow for all samples. However, the announcement period abnormal returns are positively related to cash level for large special dividends and self-tender offers, but not for regular dividend increases. Lie (2000) concludes that the analysis of the stock price reactions suggests that self-tender offers and large special dividends reduce agency problems associated with cash level.

In short, in the case of regular dividend, Lang and Litzenberger (1989) provide some evidence supporting the free cash flow hypothesis, but Denis, Denis, and Sarin (1994); Yoon and Starks (1995); and Lie (2000) find no evidence supporting the hypothesis.

2.2.2. The information/signaling hypothesis

The empirical results for the information/signaling hypothesis provide much evidence that unexpected dividend changes are associated with price changes in the same direction. Prices go up when dividends are increased or initiated and fall when dividends are decreased or omitted. However, the evidence that dividend changes predict changes in future earnings is rather mixed. For example, Watts (1973), Gonedes (1978), and DeAngelo et al. (1996) find no association between changes in future earnings and current unexpected dividends. However, Healy and Palepu (1988), Brickley (1983), and Aharony and Dotan (1994) provide evidences supporting the information/signaling hypothesis.

Unlike many prior studies, which are constrained by the limited number of firms, that of Benartzi et al. (1997) uses a large number of firms and events over the period 1979-1991 to investigate the relation between dividend changes and changes in future earnings. They find no evidence of a positive relationship. Similarly, Grullon, Michaely, and Swaminathan (2002) show that firms that increase dividends experience a decline in profitability during the years after the dividend change.

However, Nissim and Ziv (2001) point out that the regression model used by Benartzi et al. (1997) has specification issues. Nissim and Ziv (2001) use return on equity and past changes in earnings in regressions to control for the mean reversion and autocorrelation in earnings. Such a regression model implies that the rate of mean reversion and level of autocorrelation are uniform across all observations. After modifying the regression model, Nissim and Ziv (2001) find that dividend changes are positively related to earnings changes in each of the two years following the event.

Grullon et al. (2005) argue that based on empirical evidence, the mean reversion process of earnings and the level of autocorrelation are highly nonlinear, assuming linearity has the same consequences as leaving out relevant independent variables.[7] After controlling for the nonlinear patterns in the behavior of earnings, Grullon et al. (2005) show that dividend changes contain no information about changes in future earnings.

3. Methodology

Bar-Yosef and Sarig (1992) suggest a method of identifying dividend surprises (not normalized unexpected dividend changes). The basic idea is that option prices are

[7] For some explanation about the empirical evidence, see Grullon et al. (2005).

derived from the underlying stock prices, but option holders are not given dividends. Prior to dividend announcements (after dividend announcements), option and stock prices reflect the expected dividend payments (actual dividend payments) differently. Hence, by comparing the relative change in these prices, we can deduce dividend surprises.

First, we explain how to infer dividend expectations using the equation of put-call parity with dividends. Consider (i) portfolio A of one European call option plus an amount of cash equal to PV(DIVI) + K * B_t, where PV(DIVI), K, and B_t are the present value of expected interim dividends, exercise price, and the time-t price of zero coupon bond maturing on the common expiration day of the option; and (ii) portfolio B of one European put option plus one share stock. Since both portfolios have the same value at expiration day, they have identical values today. This means that

$$c + PV(DIVI) + K^* B_t = p + S. \quad (1)$$

Equation (1) can be rewritten as

$$PV(DIVI) = S - (c - p + K * B_t), \quad (2)$$

where S, c, and p are the price of the underlying stock, the European call, and the

European put.

The option price in Equation (2) is in European prices. However, since we only have American options, we have to convert equation (2) to American prices. We define the American option over European option premium for calls and puts as

$$\Delta c \equiv C - c \geq 0 \qquad (3)$$

$$\Delta p \equiv P - p \geq 0, \qquad (4)$$

where C is the American call price and P is the American put price. Thus, we derive the equation:

$$PV(DIVI) + (\Delta p - \Delta c) = S - C + P - K^{*} B_t. \qquad (5)$$

We define dividend surprises as subtracting expected dividends implied from the pre-announcement option, and stock prices from expected dividends implied from post-announcement prices. Let A be the observed prices after the dividend is announced and B the observed prices before the dividend is announced. Dividend surprises can be expressed as:

$$DIVS = PV(DIVI)^{A} - PV(DIVI)^{B} + [(\Delta p^{A} - \Delta p^{B}) - (\Delta c^{A} - \Delta c^{B})]. \qquad (6)$$

Bar-Yosef and Sarig (1992) claim that the premium of equations (3) and (4) is small.[8] Moreover, their empirical results show that the American-over-European-option premium has little effect on the measurement of dividend surprises when the price-based method is used. Hence, equation (5) can be used to estimate the expected dividends before and after dividend announcement. We can deduce dividend surprises by subtracting expected dividends implied from the pre-announcement prices from expected dividends implied from post-announcement prices,

Bar-Yosef and Sarig (1992) show that the stock market reaction to dividend announcements is more highly correlated with dividend surprises deduced from the abovementioned method than with dividend surprises calculated from other methods used in prior studies, such as the naïve, Linter, Box-Jenkins, and analysts' dividend forecasts methods. We therefore apply the method used by Bar-Yosef and Sarig (1992) in yielding dividend surprises and use it to test different hypotheses.

4. Sample Selection and Description

4.1 *Sample selection*

The sample of regular quarterly US dividends is obtained from CRSP daily

[8] See Bar-Yosef and Sarig (1992).

master tapes (code No. 1232 in the CRSP file) from 1996 to 2007. For the dividends to be included in the sample, the following criteria have to be satisfied:

(1) The dividend announcement does not represent a dividend initiation.

(2) No other type of distribution was made between the two quarterly dividends (following Dennis, Denis and Sarin, 1994; Yoon and Starks, 1995; and Lie, 2000).

(3) The firm's financial data are available on the CRSP and Compustat.

(4) The firm is not a financial institution.

Since the calculation of unexpected dividend changes needs the data of option and stock prices, we collect option prices from OptionMetrics. Following Bar-Yosef and Sarig (1992), option prices need to satisfy the following qualifications:

(1) The expiration date of the option is before the subsequent ex-dividend day and after the upcoming ex-dividend day.

(2) The price of the option is at least $0.5.

(3) The bid-ask spread is less than 25% of the bid price.

With the same exercise price and maturity for call and put prices, expected dividends are calculated using equation (5) from each day's triplet of observed call, put, and stock prices. For each dividend announcement, we have many expected dividends both before and after the dividend announcement, including different exercise price. We use option prices from trade days -4 to -2 (relative to the dividend announcement day) and from trade days 1 to 3. First, we delete the top and bottom 20% of the expected dividends, both before and after the dividend announcement to avoid the effect of extreme value. Then we average expected dividends from trade days -4 to -2 to produce the average expected dividend before the announcement day, and from trade days 1 to 3 to yield the average expected dividend after the announcement day. Finally, if there are at least four option trades before and after the announcement day, we calculate the dividend surprise which is the difference between the average expected dividend implied before the announcement day and that which is implied after the announcement day. Thus, for each dividend announcement, we have a dividend surprise. Noticeably, there is not only one way to calculate dividend surprises. When we have options with various exercise prices, dividend surprises can be estimated for each exercise price separately. Then, we average these dividend surprises. However, using this procedure to result in dividend surprises, we find that the relationship between announcement period abnormal returns and normalized dividend surprises is negative, which is not consistent with the empirical results of Bar-Yosef and Sarig (1992).[9] Thereby, in the process of calculating dividend surprises, we don't require the same exercise price when estimating expected

[9] Maybe the reason is that our option prices are daily data.

dividends both before and after dividend announcement. We define dividend surprise as not normalized unexpected dividend changes. After merging Compustat and CRSP data, we have 15,694 dividend surprises. Since our focus is on dividend increases, we require that the dividend changes are dividend increases.[10] Finally, we arrive at 2,135 dividend surprises, of which 1,364 are positive and 771 are negative.

4.2 *Sample description*

4.2.1. Summary statistics for dividend increases and dividend surprises

Panel A of Table 1 presents summary statistics for dividend increases and dividend surprises. DIV is the announced dividend per share and ΔDIV is the dividend change, which is the difference between the announced dividend and dividend in the previous quarter. Many empirical studies use normalized dividend change as unexpected dividend change if the dividend expectation is based on the naïve expectation model. DIVS is dividend surprise. Based on the dividends (changes of which are increases), the mean of announced dividends is 0.2249; the lowest value is 0.0075, and the highest is 2.75. The mean and median of dividend increases are 0.0282 and 0.02, and those of dividend surprises are 0.0472 and 0.0301. The difference between the mean (median) of dividend surprises and the mean (median) of

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[10] Since the data include only a few dividend decrease samples, we focus on dividend increases.

dividend changes is 0.019 (0.01).

[Insert Table 1]

4.2.2. Summary statistics and distribution for some variables

Panel B of Table 1 provides descriptive statistics for some variables for the period 1996-2007. Excluding the announcement period abnormal returns and unexpected dividend changes, all financial variables are measured at the end of the fiscal year before that when the announcement of dividends is made. The mean (median) figures are: market value of equity, $19,883 million ($6,065 million); book value of assets, $13,955 million ($4,355 million), compared with $21,621 million ($3,461 million) of regular dividend increases on the CRSP tapes for the period; announcement period abnormal returns to dividend increase announcements, 0.004 (0.004), suggesting that the market interprets dividend increase announcements as favorable news; unexpected dividend changes, 0.377 (0.182); and Tobin's q, 1.831 (1.421). Finally, comparing the cash flow and cash level statistics, we find that although the mean of cash flow is close to that of cash level, the variation of cash level is greater than that of cash flow. For cash level and cash flow, the standard deviations are 0.579 and 0.079. Table 2 presents the median value for announcements period abnormal returns, Tobin's q, cash flow, and cash level by fiscal year. Median Tobin's q and median cash flow for fiscal years 1996 to 2007 are rather stable, remaining at 1.4 and 0.1. Median announcement abnormal returns and median cash level have more variation for fiscal years 1995 to 2008, however, and their trend is upward. The cash level seems to have more flexibility than the cash flow in explaining the variation of announcement period abnormal returns.

[Insert Table 2]

5. Empirical Test of the Free Cash Flow Hypothesis

5.1. *Analyses of announcement period abnormal returns for dividend increases based on Tobin's q and cash flow (cash level)*

Table 3 reports the mean and median announcement period abnormal returns for dividend increases based on Tobin's q and cash flow (cash level). The medians of panels A and B are determined by sample median, and the medians of panels C and D are determined by fiscal year. The Tobin's q of low q firms is less than the median for the sample, as is the cash flow (cash level) of low cash flow (cash level) firms. Announcement period abnormal returns are defined as the difference between actual returns and expected returns over the announcement period. Expected returns are estimated from the standard market model. We estimate the market model over 250 trading days, ending 10 days before the day the dividend announcement was made.

The announcement period abnormal returns start on the second day before the announcement date and end on the second day after the announcement date. We follow Lehn and Poulsen (1989) in defining cash flow as operating income before depreciation minus interest expenses, taxes, preferred dividends, and common dividends. The cash flow is scaled by cash-adjusted assets (i.e., the book value of assets less cash and short-term investments). Cash level is defined as cash and short-term investments divided by cash-adjusted assets. Tobin's q is an indicator of investment opportunities for a firm, and low q refers to poor investment opportunities. Following Song and Walkling (2000), we calculate Tobin's q using the equation:

$$\text{Tobin's } q = (S + P + D - NWC) / CAT, \qquad (7)$$

where S is the market value of equity; P is the liquidating value of preferred stock; D is the book value of long-term debt; NWC is the net working capital; and CAT is cash-adjusted assets.

[Insert Table 3]

Panels A and B of Table 3 indicate that excluding the median announcement period abnormal returns of low q and high cash flow firms, the announcement period abnormal returns for firms with low q and high cash flow (cash level) are significantly different from zero at the 5% significance levels. This implies that the market perceives dividend increases by firms with poor growth opportunities and high cash flow (cash level) as favorable news. However, when median Tobin's q and median cash flow (median cash level) are determined by fiscal year, we find that the announcement period abnormal returns are still positive, but their respective statistics are not significant (excluding the mean announcement period abnormal returns of low q and high cash flow firms). Seemingly, mean and median announcement period abnormal returns are affected by different classification. In addition, the analysis in Table 3 does not control for some variables that might affect announcement period abnormal returns. Hence, in the next section, we use regression to control for some variables that affect announcement period abnormal returns to analyze the relationships among announcement period abnormal returns, Tobin's q, and cash flow (cash level).

5.2. *Regression analysis*

Prior studies have proven that dividend yield, size of a firm, and dividend changes are important influential factors in explaining stock market reactions to announcements of dividend change. Dividend yield is used as a proxy for clientele effects (Bajaj and Vijh, 1990). Size of a firm is suggested as a proxy variable reflecting information asymmetry between large and small firms. Dividend changes, according to the information/signaling hypothesis, predict changes in future earnings.

In addition, the 2003 dividend tax reform may influence the preferences of investors for dividends. Therefore, we include these four variables in a regression as control variables in testing the free cash flow hypothesis. According to the predictions of the free cash flow hypothesis, announcement period abnormal returns should be positively correlated with excess funds. And this association is stronger in low q than in high q firms, if no other factor affects the relation between the announcement period abnormal returns and excess funds for high q firms.

Table 4 reports the results of regression of announcement period abnormal returns using actual dividend increase divided by previous quarter dividend as a proxy variable for unexpected dividend increase. We find that announcement period abnormal returns are uncorrelated with normalized actual dividend increase. It implies that dividend increases don't convey information to stock market. Since announcement period abnormal returns are mainly affected by unexpected dividend changes, we reuse dividend surprise scaled by previous-quarter dividend as a measure for unexpected dividend increase. Table 5 represents the results of regression of announcement period abnormal returns. We find that announcement period abnormal returns are significantly positively correlated with unexpected dividend changes. However, the coefficient of the cash flow of low q firms in model (1) and the coefficient of the interaction term equal to the product of low q and cash flow in model (2) are insignificantly different from zero at the standard significance level. The cash flow analysis indicates that positive announcement period abnormal returns do not reflect the phenomenon of a decrease in overinvestment when low q firms announce increases in dividends.

When using the cash level in place of cash flow as a proxy variable for excess funds, we find that in model (3) of Table 5, the coefficient of the cash level of low q firms is positive and significantly different from zero at the 5% significance levels. The announcement period abnormal returns to dividend increases announcements are higher when low q firms have a higher cash level. The reason is that the higher the cash level of a low q firm, the bigger the possibility that the firm will overinvest. Thus, the dividend increases for firms with low q and higher cash level may reduce their overinvestment. In addition, in models (4) and (5), the coefficient of the interaction term equal to the product of low q and cash level is also positive and significantly different from zero at the 5% significance levels, whether we include Tobin's q or not. The positive association between the announcement period abnormal returns and cash level is stronger for low q firms than for high q firms. Finally, in model (6) of Table 5, the coefficient of Tobin's q is insignificant, which is similar to the results of Yoon and Starks (1995). A possible reason is that announcements of increase in dividends by high q firms may signal their future earnings. Accordingly, we directly examine the sources of stock returns suggested by the free cash flow hypothesis.

[Insert Table 4 and 5]

5.3. Changes in capital expenditures and R&D expenses

The free cash flow hypothesis claims that low q firms will have positive abnormal returns after dividend increase announcements because dividend increases prompt the market to expect lower amount of cash to be invested in negative NPV projects. Thus, for low q firms, there ought to be a decrease in capital expenditure and R&D expenses after dividend increases.

Therefore, we examine changes in capital expenditures and R&D expenses standardized by the average of beginning- and ending-period book value of total assets for low q firms. Following Grullon and Michaely (2004), we use two benchmarks to measure unexpected changes in capital expenditures and R&D expenses. First, we assume that the unexpected change is equal to the change in capital expenditures and R&D expenses. Second, we define unexpected change as the difference between a change in capital expenditures and R&D expenses for a sample firm, and change in capital expenditures and R&D expenses for a matching firm that has the same two-digit SIC code. The change in capital expenditures and R&D expenses of the matching firm must have the closest change to that of the sample firm from fiscal year -2 to fiscal year -1. If no firm meets the criteria, we discard the two-digit SIC code for a one-digit SIC. To reduce confounding effects, we consider only matching firms that are high q firms and do not have dividend increases during the year of the event and the four years afterwards. In this section, low q firms are those firms whose Tobin's q is smaller than median Tobin's q; Median Tobin's q is determined on a per-fiscal year basis.

In Table 6, we find that low q firms reduce their capital expenditures and R&D expenses during the four fiscal years that follow the year when the announcement of dividend increase was made. Low q firms, on average, decrease capital expenditures and R&D expenses by 1.2% of expenses in fiscal year 0 (i.e., the dividend increase announcement year) in the fourth year following the dividend increase announcement (median = -0.6%). When comparing the sample and matching firms, we also find that low q firms decrease capital expenditures and R&D expenses by 1.5% of expenses in fiscal year 0. The median value is still negative although insignificant. When we examine the unadjusted changes in capital expenditures and R&D expenses of matching firms, we find no evidence showing that matching firms reduce their capital expenditures and R&D expenses. Furthermore, to understand whether our results also happen in firms with high cash, we analyze the sample whose Tobin's q is smaller than the median, and whose cash is greater than the median. Table 7 presents similar results. Thus, low q firms with a cash-high level also decrease their capital expenditures and R&D expenses during the four fiscal years that follow the year when the announcement of dividend was made.

In other words, our regression results show that in the case of regular dividend increases, (i) announcement period abnormal returns are higher in low q firms with a higher cash level, (ii) the positive association between announcement abnormal returns and the cash level is stronger when firms have poor investment opportunities, and (iii) low q firms reduce their capital expenditures and R&D expenses during the four fiscal years following the dividend increase announcement. Our empirical results provide evidence supporting the free cash flow hypothesis.

[Insert Tables 6 and 7]

6. Empirical Test of the Information/Signaling Hypothesis

Since prior papers have provided a evidence of the positive relationship between dividend changes and abnormal stock returns, our main interest in this section is to explore whether dividend increases signal future earnings increases. The signaling hypothesis test will be carried out using two methods: the matched-sample approach and a regression analysis controlling for the nonlinearities of the earning process.

6.1. *The matched-sample approach*

Following Lie (2005), we use quarterly data to analyze operating performance of a firm after announcement of a dividend increase. Operating performance is defined as operating income before depreciation, scaled by the average of cash-adjusted assets (book value of assets less cash and short-term investments) at the beginning and end of a fiscal quarter. To understand the operating performance of the said firm, we analyze unadjusted performance and adjusted operating performance. Unadjusted performance is simply the operating performance of a firm with dividend increases. Adjusted performance is unadjusted performance less the performance of control firms that did not increase dividends during the fiscal year when the sample firms announced an increase in dividends and for three fiscal years afterwards. Like Lie (2005), we also have two types of control firms. The first type is composed of firms in the same industry whose size are similar to that of the sample firms. For each sample firm, we select a control firm with the same two-digit SIC code and closest average book value of asset at the beginning and end of the fiscal quarter. The adjusted performance based on the control firms is called industry-adjusted performance. The second type comprises firms in the same industry that have similar pre-event performance characteristics and market-to-book ratio. For each sample firm, we first identify all firms that have the same fiscal year, quarter, and two-digit SIC code. Then we look for control firms (i) whose operating performances are within ±20% or within ±0.01 of the performance of the sample firm in the announcement quarter (quarter 0); (ii) whose operating performance for four quarters ending with quarter 0 is within ±20% or ±0.1 of the corresponding performance of the sample firm; and (iii) whose pre-announcement market-to-book ratio of asset is within ±20% or ±0.1 of that of the sample firm. We match the firms based on pre-announcement performance characteristics and market-to-book ratio because these characteristics contain information about future operating performance.[11] If no firm meets these criteria, the industry criterion is changed to a one-digit SIC code. If still no firm is found, we choose the firms with the lowest sum of absolute differences, which is defined as

$$|\text{Performance}_{\text{sample firm, quarter 0}} - \text{Performance}_{\text{control firm, quarter 0}}| + |\text{Performance}_{\text{sample firm, four quarter ending with quarter 0}} - \text{Performance}_{\text{control firm, four quarters ending with quarter 0}}|. \qquad (8)$$

If the sample firms do not have operating performance data for any of the four quarters, we omit the second term of equation (8). The adjusted performance based on these control firms is called performance-adjusted performance.

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[11] See Barber and Lyon (1996) and Fama and French (2000).

Tables 8 and 9 show the unadjusted and adjusted performances of the sample firm. Although the unadjusted performance is positive both prior and subsequent to dividend announcements, the changes in unadjusted performance from the announcement quarter (quarter 0) to the seventh quarter after the dividend announcement represent deterioration. In particular, the changes in performance from quarters 0 to 5 are most obvious. For instance, the mean change in performance is -0.002 during the seasons from quarters 0 to 5, which amounts to a percentage change of -3.5% (-0.002/0.057). The median change in performance is -0.001 during the seasons from quarters 0 to 5, which amounts to a percentage change of -2.1% (-0.001/0.048). Furthermore, we also classify the samples that have increase in dividends into positive or negative dividend surprises samples, and separately analyze the unadjusted performance of the firms. In an unlisted table, the results are similar for all samples. For example, the mean change in performance during the seasons from quarter 0 to quarter 4 is -1.7% (-0.001/0.057) for the positive dividend surprises sample and -3.6% (-0.002/0.055) for negative dividend surprises sample. Based on abovementioned analysis, we know that the changes in unadjusted performance following dividend announcements have a diminishing trend, suggesting a mean reversion in performance. Therefore, when trying to uncover unexpected changes in performance of firms, we have to control expected performance. The industry-adjusted performance and performance-adjusted performance are designed to achieve such requirements.

In Table 8, the performance level of the sample firm is better than that of its industry peers. The industry-adjusted performance is positive at the 1% significance level, both before and after the dividend announcements. However, Table 9 shows that the changes in industry-adjusted performance display deteriorations from the time announcements of increase in dividends are made to the future quarters. For example, the mean and median changes in industry-adjusted performance during the quarters from season 0 to season 4 are -0.002 and -0.001; both are statistically different from zero at the 1% levels of significance. It means that the firms that announce dividend increases do not perform better than their industry peers when changes in operating performance are considered. The same is true for the positive and negative dividend surprises sample.

[Insert Tables 8 and 9]

Finally, when considering performance-adjusted performance, the firms that announce increase in dividends perform better than the control firms, not only in the levels of operating performance, but also in the changes in operating performance. In Tables 8 and 9, the levels of and changes in performance-adjusted performance from quarters 2 to 7 show significant improvements. For example, the mean and median levels of performance-adjusted performance during quarter 2 are 0.003 and 0.001, and their corresponding t values are significant at the 5% and 1% levels of significance. In addition, the mean and median changes in performance-adjusted performance during the seasons from quarters 0 to 2 are 0.003 and 0.002, which are also significant at the 1% levels of significance. From then on, the performance improvements persist until the 7th quarter relative to that during the quarter when the dividend announcement was made. Particularly noteworthy in Tables 8 and 9 is that the performance improvements begin in quarter 2 and persist for one-and-a-half years.

In other words, Tables 8 and 9 show that dividend increase announcements tend to represent performance improvements, which persist for one-and-a-half years. Thus, dividend increase announcements seem to convey favorable information about future operating performance.

6.2. *Regression analysis*

The second method for analyzing the relation between changes in dividends and future earnings is regression analysis. Since prior studies indicate that the mean reversion process of earning and the level of autocorrelation (i.e., momentum) are highly nonlinear, it is important for us to choose an appropriate model that can capture the features of the earning process.[12] Once the process of earning is defined, we can analyze the relation between unexpected dividend changes and unexpected earnings changes. Grullon et al. (2005) indicate that the regression model that they use to capture the earning process is the modified partial adjustment model. The model presumes that the earning process is nonlinear; Fama and French (2000) show that it explains the process of earning much better than a linear model does. To compare our empirical results with that of Grullon et al. (2005), we employ the regression equation that Grullon et al. (2005) use in their paper.

The regression model is

$$\begin{aligned}(\mathrm{EBITDA}_1 - \mathrm{EBITDA}_0)/\mathrm{AT}_{-1} = {} & \alpha_0 + \beta_1 \mathrm{DPC}_0 \times \mathrm{UEDC}_0 + \beta_2 \mathrm{DNC}_0 \times \mathrm{UEDC}_0 \\ & + (\beta_3 + \beta_4 \mathrm{NDFED}_0 + \beta_5 \mathrm{NDFED}_0 \times \mathrm{DFE}_0 + \beta_6 \mathrm{PDFED}_0 \times \mathrm{DFE}_0) \\ & \times \mathrm{DFE}_0 + (\beta_7 + \beta_8 \mathrm{NCED}_0 + \beta_9 \mathrm{NCED}_0 \times \mathrm{CE}_0 + \beta_{10} \mathrm{PCED}_0 \times \mathrm{CE}_0) \\ & \times \mathrm{CE}_0 + \varepsilon_t, \qquad (9)\end{aligned}$$

where EBITDA_1 is the operating income before depreciation in period 1. A period contains some quarters. Period 0 is a period including unexpected dividend change. AT_{-1} is the book value of total assets at end of period -1. UEDC_0 is unexpected dividend change in the last quarter of period 0. Unexpected dividend changes are defined as dividend surprises scaled by previous-quarter dividends. DPC_0 (DNC_0) is a

[12] See Grullon, Michaely, Benartzi, and Thaler (2005).

dummy variable that takes the value of 1 for positive (negative) unexpected dividend changes and 0 otherwise. ROA_0 is defined as $EBITDA_0$ / AT_0. DFE_0 is equal to ROA_0 – $E[ROA_0]$, where $E[ROA_0]$ is the predicted value from the regression of ROA_0 on the logarithm of total assets in period -1, the logarithm of the market-to-book ratio of equity in period -1, and ROA_{-1}. CE_0 is equal to $(\text{EBITDA}_0 - \text{EBITDA}_{-1}) / \text{AT}_{-1}$. $NDFED_0$ ($PDFED_0$) is a dummy variable that takes the value of 1 when DFE_0 is negative (positive) and 0 otherwise. $NCED_0$ ($PCED_0$) is a dummy variable that take the value of 1 when CE_0 is negative (positive) and 0 otherwise.

For completeness, we also report the empirical results of the regression model that Nissim and Ziv (2001) use in their paper. Their regression model assumes that the relation between future and past earnings changes is linear.

The regression model is

$$(\text{EBITDA}_1 - \text{EBITDA}_0) / \text{AT}_{-1} = \alpha_0 + \beta_1 \text{DPC}_0 \times \text{UEDC} + \beta_2 \text{DNC}_0 \times \text{UEDC} + \beta_3 \text{ROA}_{t-1} + \beta_4 (\text{EBITDA}_0 - \text{EBITDA}_{-1}) / \text{AT}_{-1} + \varepsilon_t \quad (10)$$

Before testing the information/signaling hypothesis by using the abovementioned regression, we first analyze the association between normalized actual dividend changes and future earnings changes.

6.2.1. The relationship between normalized actual dividend changes and future earnings changes

Prior studies normally use the naïve expectations model to define unexpected dividend change, which is the proportional change in dividends from the previous quarter.[13] We want to know what the empirical results will be for our sample if we also define unexpected dividend change as actual dividend change divided by the previous quarter dividend in regressions (9) and (10). Therefore, we analyze the relationship between actual dividend changes scaled by the previous-quarter dividend and future earnings changes. Table 10 reports the results of regressions (9) and (10). The coefficient of normalized actual dividend changes in model (1) is equal to 0.001 when a period is defined as one year, and 0.026 when it is defined as one-and-a-half years. Their corresponding t value is significant. The result is consistent with the findings of Nissim and Ziv (2000) and Grullon et al. (2005). When a period is defined as two years, the coefficient of normalized actual dividend changes in model (1) is insignificant from zero at standard significance levels.

However, when controlling for the nonlinearities in the earning process, our

[13] See Benartzi et al. (1997), Nissim and Ziv (2000), and Grullon et al. (2005).

empirical results show that in models (2) and (4), the coefficients of normalized actual dividend changes are all insignificant, which is consistent with the findings of Grullon et al. (2005). Overall, when we define unexpected dividend changes as actual dividend changes scaled by the previous-quarter dividend, our empirical results reveal that dividend changes convey no information about future changes in earnings.

[Insert Table 10]

6.2.2. The relationship between unexpected dividend changes and future earnings changes (with operating income before depreciation as the performance measure)

In testing the information/signaling hypothesis, we first analyze the relationship between unexpected dividend changes calculated from the price model and changes in operating income before depreciation. Indeed, Grullon et al. (2005) claim that the "dividend-signaling theory does not indicate precisely which firm performance metric (e.g., future income or future profitability) should be used." Therefore, we first use operating income before depreciation (EBITDA) as a firm's performance metric. In addition, unexpected dividend changes calculated from the price model are divided into positive and negative unexpected dividend changes. In the regression analysis, they are all used as explanatory variables in testing the relationship between unexpected dividend changes and unexpected earnings changes. In addition, to reduce the confounding effect, we use only the sample that does not have overlapping calculations of operating income before depreciation between periods.

Table 11 reports the estimates of regression using operating income before depreciation as a firm's performance metric. When the period is one year or two years, we find no evidence that dividend increases are correlated with future increases in earnings. However, when the period is one-and-a-half years, the coefficient of positive unexpected dividend changes in model (3), β_1, is positive and significant at the 10% significance levels. Furthermore, after controlling for the nonlinear process of performance, the coefficient of positive unexpected dividend changes in model (4), β_1, is still positive and significant at the 5% significance levels. This indicates that dividend increases with positive unexpected dividend changes seem to convey some information about future earnings changes. However, we cannot exclude the possibility that the significance of β_1 in model (4) may be due to the seasonal effect. In contrast, the coefficient of negative unexpected dividend changes, β_2, is insignificant at standard significance levels. It means that dividend increases with negative unexpected dividend changes do not provide information about changes in future earnings. Overall, when we use operating income before depreciation as a performance measure, dividend increases with positive unexpected dividend changes provide only little information about changes in future earnings.

[Insert Table 11]

6.2.3. The relationship between unexpected dividend changes and future earnings changes (with earnings before extraordinary items as the performance measure)

In addition to operating income before depreciation, we also use earnings before extraordinary items as a performance measure to test the information/signaling hypothesis. The regression is rewritten as

$$\begin{aligned}\left(\mathrm{E}_1 - \mathrm{E}_0\right)/\,\mathrm{B}_{-1} = {} & \alpha_0 + \beta_1 \mathrm{DPC}_0 \times \mathrm{UEDC}_0 + \beta_2 \mathrm{DNC}_0 \times \mathrm{UEDC}_0 \\ & + (\beta_3 + \beta_4 \mathrm{NDFED}_0 + \beta_5 \mathrm{NDFED}_0 \times \mathrm{DFE}_0 + \beta_6 \mathrm{PDFED}_0 \times \mathrm{DFE}_0) \\ & \times \mathrm{DFE}_0 + (\beta_7 + \beta_8 \mathrm{NCED}_0 + \beta_9 \mathrm{NCED}_0 \times \mathrm{CE}_0 + \beta_{10} \mathrm{PCED}_0 \times \mathrm{CE}_0) \\ & \times \mathrm{CE}_0 + \varepsilon_t , \qquad (11)\end{aligned}$$

where E_1 is earnings before extraordinary items in period 1; B_{-1} is the book value of equity at the end of period -1; DFE_0 is equal to ROE_0 – $E[ROE_0]$, in which ROE_0 is defined as earnings before an extraordinary item in period 0, scaled by the book value of equity at the end of period 0, and $E[ROE_0]$ is the predicted value from the regression of ROE_0 on the logarithm of total assets in period -1, the logarithm of the market-to-book ratio of equity in period -1, and ROE_{-1}; and CE_0 is equal to $(E_0 – E_{-1})$ /

B_{-1}. Other variables are defined as in equation (7).

In addition, the regression model of Nissim and Ziv (2001) is also rewritten as

$$(E_1 - E_0)/B_{-1} = \alpha_0 + \beta_1 DPC_0 \times UEDC + \beta_2 DNC_0 \times UEDC + \beta_3 ROE_{-1} + \beta_4 (E_0 - E_{-1})/B_{-1} + \varepsilon_t \quad (12)$$

Table 12 shows the estimates of the regression using earnings before extraordinary items as a firm's performance metric. In the regression, we find a stronger relationship between positive unexpected dividend changes and unexpected earnings changes compared with the results of regressions (9) and (10), suggesting that dividend increases with positive unexpected dividend changes convey some information about future increases in earnings. For example, in model (1) and (3), the coefficient on positive unexpected dividend changes is 0.003 when the period is one year and 0.015, when the period is one-and-a-half years. Their corresponding White's t-statistic is significant at the 1% significance levels. The results in model (1) and (3) are consistent with the empirical results of the studies by Nissim and Ziv (2001) and Grullon et al. (2005). After controlling for the nonlinear patterns in the behavior of earnings, we find that positive unexpected dividend changes are still positively and significantly correlated with future earnings changes. For instance, in models (2) and (4), the coefficient of positive unexpected dividend changes is 0.006 when the period is one year and 0.012, when the period is one-and-a-half years. Their corresponding

White's t-statistic is significant at the 5% significance levels. However, like what is shown in the abovementioned analysis, the coefficient of negative unexpected dividend changes, β_2, is still insignificant at the standard significance levels. If a period is further extended to two years, the results are similar to that of Table 11.

In summary, the empirical results of the match-sample approach show that announcements of dividend increases present performance improvements from quarters 2 to 7 (the quarter when the announcement of dividend increase was made is quarter 0), and the performance improvements persist for one-and-a-half years. It seems that dividend increases signal increases in future earnings. In the regression analysis, after controlling for the earning process, we find that when earnings before extraordinary items are used as a performance measure, the dividend increases convey some information about increases in future earnings if their unexpected dividend changes calculated from the price model are positive. However, when operating income before depreciation is used as a performance measure, the dividend increases provide very limited information even if their unexpected dividend changes are positive. Thus, by using different performance measures, we obtain different empirical results. Hence, we have no definite evidence supporting the information/signaling hypothesis.

[Insert Table 12]

7. Robustness

In this section, we perform some robustness checks to observe whether the regression results of Table 5 would still hold if a variable were replaced by another variable. In models (1) and (2) of Table 13, announcement period abnormal returns are calculated by using the CRSP daily value weighted index as a proxy for the market index. In models (3) and (4) of Table 13, we define unexpected dividend changes as dividend surprises scaled by the market value of equity five days before the dividend announcement (following Lie, 2000). Then the value is multiplied by 100. In models (5) and (6) of Table 13, we define Tobin's q as the ratio of a firm's market value (defined as the book value of total assets minus the book value of equity plus the market value of equity) to the book value of the assets (following Jung, Kim, and Stulz, 1996). Table 13 reports the results of the robustness checks for the regression of announcement period abnormal returns.

When announcement period abnormal returns are calculated by using the CRSP daily value weighted index as a proxy for the market index, the announcement period abnormal returns are still positively related to unexpected dividend changes; the association between the announcement period abnormal returns and the cash level is significantly positive for low q firms. Although the coefficient on interaction term equal to the product of Tobin’s q and cash level is insignificant, the positive association between announcement period abnormal returns and cash level is higher in low q than in high q firms. When unexpected dividend changes are defined as dividend surprises scaled by the market value of equity five days before the dividend announcement, the results are similar those of the previous analysis presented in Table 5. Furthermore, when Tobin’s q is defined as the ratio of market value of a firm to the book value of assets, the results are similar to those of models (1) and (2) of Table 13. In addition, we are also concerned about whether the abovementioned definition of Tobin’s q will change the results of capital expenditures and R&D expenses of low q firms. In Table 14, we find that the empirical results are similar to the results presented in Tables 6 and 7. The capital expenditures and R&D expenses for low q firms represent decreases during the four fiscal years following the dividend increases announcements.

In other words, the regression results presented in Table 5 are robust even if some variables are changed. The capital expenditures and R&D expenses for low q firms defined by the alternative definition of Tobin’s q also represent the decreases during the four fiscal years following the dividend increase announcements.

[Insert Tables 13 and 14]

8. Summary and Conclusions

Announcement of change in regular dividends affects value of a firm. There are two main hypotheses explaining what information is conveyed to the market by this phenomenon: the free cash flow and information/signaling hypotheses. Prior studies testing the free cash flow and information/signaling hypotheses define unexpected dividend change as the proportional change in dividends from the previous quarter to analyze the association between announcement period abnormal returns and unexpected dividend changes, or they define unexpected dividend change as the annualized rate of quarterly dividend changes to examine the relationship between unexpected earnings changes and unexpected dividend changes.

However, in the case of regular dividend increases, there is a chance that investors will form expectations about dividends in the next quarter. The announcement period abnormal returns mainly reflect the effects of unexpected dividend changes. Similarly, in analyzing the variation of unexpected earnings changes, a suitable explanatory variable should be used for unexpected dividend changes. The question is how to measure unexpected dividend changes. This paper adopts a method suggested by Bar-Yosef and Sarig (1992) in measuring dividend surprises. The unexpected dividend changes are defined as dividend surprises scaled by the previous-quarter dividends. Dividend surprises are calculated by subtracting dividend expectations imputed from the pre-announcement option and stock prices from expectations imputed from post-announcement prices.

In testing the free cash flow hypothesis, we find that announcement period abnormal returns are positively related to unexpected dividend changes; the relation between announcement period abnormal returns and the cash level is significantly positive for low q firms. Moreover, the positive association between announcement period abnormal returns and the cash level is stronger in low q than in high q firms. Furthermore, low q firms reduce their capital expenditures and R&D expenses during the four fiscal years that follow dividend increase announcements. Our empirical results are consistent with the free cash flow hypothesis.

In testing the information/signaling hypothesis, we use two methods: the matched-sample approach and regression analysis. The empirical results of the match-sample approach show that dividend increases seem to signal increases in future earnings. However, after controlling for the process of earning in the regression analysis, we find that our empirical results do not provide definite evidence supporting the information/signaling hypothesis.

Although the free cash flow and the information/ signaling hypotheses are not mutually exclusive, our empirical results provide more evidence supporting the free cash flow hypothesis.

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Table 1. Summary Statistics

Table1 reports summary statistics for the sample between 1996 and 2007. Panel A provides summary statistics for dividend increases and dividend surprises. DIV is the announced dividend per share. ΔDIV is the dividend change, which is the difference between the announced dividend and the previous quarter dividend. ΔDIV>0 is dividend increase. DIVS is dividend surprise which is not normalized unexpected dividend change. DIVS>0 is positive dividend surprises; and DIVS<0, negative dividend surprise. Panel B provides summary statistics for some variables between 1996 and 2007. All financial variables, excepting announcement period abnormal returns and unexpected dividend changes, are measured at the end of the fiscal year before the dividend announcement. The announcement period abnormal returns start on the second day before the announcement date and end on the second day after the announcement date. Unexpected dividend change is defined as dividend surprise scaled by previous quarter dividend. Tobin's q is defined as (S+P+D-NWC)/CAT, where S is the market value of equity, P is the liquidating value of preferred stock, D is the book value of long-term debt, NWC is the net working capital, and CAT is cash-adjusted assets. Cash flow is the operating income before depreciation minus interest expenses, taxes, preferred dividends, and common dividends, scaled by cash-adjusted assets (i.e., book value of assets less cash and short-term investments). Cash level is defined as cash and short-term investments divided by cash-adjusted assets.

Panel A. Summary Statistics for Dividend Increases and Dividend Surprises

Variables	N	Mean	Standard deviation	Lowest	25%	Meidan	75%	Highest
DIV(ΔDIV>0)	2,135	0.2249	0.21	0.0075	0.1	0.18	0.29	2.75
ΔDIV>0	2,135	0.0282	0.0617	0.0000	0.01	0.02	0.03	1.28
DIVS	2,135	0.0472	0.1842	-1.4271	-0.0272	0.0301	0.1023	1.883
DIVS>0	1,364	0.1247	0.1679	0.0000	0.0342	0.0763	0.1524	1.883
DIVS<0	771	-0.0899	0.1209	-1.4271	-0.1141	-0.0542	-0.0226	-0.0001

Panel B. Summary Statistics for Some Variables

Variables	Mean	25%	Median	75%
Market value of equity (milions of $)	19,883	2,117	6,065	16,247
Book value of assets (millions of $)	13,955	1,641	4,355	14,120
Announcement period abnormal returns	0.004	-0.019	0.004	0.028
Unexpected dividend change (dividend surprise/previous quarter dividend)	0.377	-0.192	0.182	0.706
Tobin's q	1.831	1.004	1.421	2.2
Cash flow (millions of $)	0.116	0.071	0.104	0.141
Cash level (millions of $)	0.169	0.017	0.049	0.143

Table 2. Median Value for Some Variables by Fiscal Year

Table 2 reports the median value for announcement period abnormal returns, Tobin's q, cash flow, and cash level. Definitions of the variables are as defined in Table 1.

Fiscal year	N	Median announcement abnormal returns	Fiscal year	N	Median Tobin's q	N	Median cash flow	N	Median cash level
1996	99	0.001	1995	94	1.438	98	0.105	99	0.028
1997	163	0.009	1996	157	1.317	160	0.103	162	0.032
1998	152	-0.003	1997	144	1.530	150	0.108	152	0.029
1999	162	-0.002	1998	158	1.428	161	0.102	162	0.028
2000	127	0.005	1999	123	1.475	123	0.103	127	0.030
2001	106	-0.001	2000	103	1.691	103	0.109	106	0.026
2002	103	0.004	2001	99	1.543	100	0.100	103	0.032
2003	190	0.004	2002	184	1.258	179	0.098	190	0.053
2004	229	0.011	2003	219	1.414	221	0.095	229	0.070
2005	282	0.004	2004	267	1.424	268	0.106	282	0.078
2006	282	0.004	2005	271	1.379	269	0.108	282	0.064
2007	236	-0.000	2006	227	1.437	225	0.107	236	0.062
Total	2131			2046		2057		2130	

Table 3. Announcement Abnormal Returns for Dividend Increases

Table 3 reports mean and median (in Parentheses) announcement period abnormal returns for dividend increases based on Tobin's q and cash flow (or cash level) over the period 1996 to 2007. Significance level is based on the parametric t-statistic for mean and the Wilcoxon signed-ranked test for the median. *, **, and *** denote significance at 10%, 5%, and 1% level, respectively. Definitions of the variables are as defined in Table 1.

Panel A. Mean and Median (in Parentheses) Announcement Period Abnormal Returns for Dividend Increases Based on Tobin's q and Cash Flow (Median is Sample Median)

	High Cash Flow (Cash Flow≥Median)	Low Cash Flow (Cash Flow<Median)
High q (Tobin's q≥Median)	0.003* (0.003**) N=722	0.002 (0.004) N=303
Low q (Tobin's q<Median)	0.007** (0.001) N=291	0.005*** (0.005***) N=734

Panel B. Mean and Median (in Parentheses) Announcement Period Abnormal Returns for Dividend Increases Based on Tobin's q and Cash Level (Median is Sample Median)

	High Cash Level (Cash Level≥Median)	Low Cash Level (Cash Level<Median)
High q (Tobin's q≥Median)	0.004* (0.003**) N=632	0.002 (0.003) N=393
Low q (Tobin's q<Median)	0.005** (0.004**) N=400	0.006*** (0.004***) N=625

Panel C. Mean and Median (in Parentheses) Announcement Period Abnormal Returns for Dividend Increases Based on Tobin's q and Cash Flow (Median is determined by fiscal year)

	High Cash Flow (Cash Flow≥Median)	Low Cash Flow (Cash Flow<Median)
High q (Tobin's q≥Median)	0.004* (0.004**) N=703	0.002 (0.003) N=323
Low q (Tobin's q<Median)	0.005* (0.001) N=286	0.005*** (0.005***) N=737

Panel D. Mean and Median (in Parentheses) Announcement Period Abnormal Returns for Dividend Increases Based on Tobin's q and Cash Level (Median is determined by fiscal year)

	High Cash Level (Cash Level≥Median)	Low Cash Level (Cash Level<Median)
High q (Tobin's q≥Median)	0.004** (0.004**) N=645	0.001 (0.004) N=381
Low q (Tobin's q<Median)	0.003 (0.001) N=389	0.006*** (0.006***) N=634

Table 4. The Regression of Announcement Period Abnormal Returns (Unexpected dividend increase is defined as actual dividend increase divided by previous quarter dividend)

Table 4 reports the regression of announcement period abnormal returns. The announcement period abnormal returns start on the second day before the announcement date and end on the second day after the announcement date. Actual dividend increase/previous quarter dividend is defined as dividend increase divided by previous quarter dividend. Market value of equity/index level is market value of equity (in billions) scaled by the level of the S&P 500 index 5 days prior to the dividend announcement. Dividend yield is defined as the total dividend disbursement during the fiscal year preceding the dividend announcement scaled by the market value of equity 5 days prior to the dividend announcement. Median Tobin's q is determined by fiscal year. Low q firms are defined as those firms which Tobin's q is less than median Tobin's q. Low q x cash flow is an interaction term equal to the product of the dummy variable of Tobin's q and cash flow and so is Low q x cash level. Tobin's q takes on a value 1 if Tobin's q is less than median Tobin's q and 0 otherwise. Cash flow-low q is the cash flow for low q firms. Cash level-low q is the cash level for low q firms. Tax-dummy takes on a value 0 if year is less than 2003 and 1 otherwise. Definitions of the other variables are defined as in Table 1.

Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.003	-0.001	-0.000	-0.000	0.000	0.002
	(0.61)	(-0.22)	(-0.04)	(-0.15)	(0.03)	(0.67)
Actual dividend increase/	0.002	0.000	0.001	0.000	0.000	0.000
previous quarter dividend	(0.79)	(0.75)	(0.47)	(0.71)	(0.70)	(0.78)
Market value of	-0.236 **	-0.069 **	-0.209 **	-0.049	-0.052	-0.059 *
equity/index level	(-2.23)	(-1.97)	(-1.97)	(-1.44)	(-1.50)	(-1.68)
Dividend yield	0.191 **	0.219 ***	0.213 **	0.211 ***	0.216 ***	0.195 ***
	(2.13)	(3.16)	(2.54)	(3.19)	(3.21)	(2.90)
Cash flow		0.019				
		(1.30)				
Cash flow-low q	-0.012					
	(-0.34)					
Low q x cash flow		-0.006				
		(-0.28)				
Cash level				0.005 **	0.004 **	
				(2.45)	(2.32)	
Cash level-low q			0.026 **			
			(2.54)			
Low q x cash level				0.022 **	0.024 **	
				(2.20)	(2.19)	
Tobin's q					-0.001	0.000
					(-0.40)	(0.05)
Tax-dummy	0.001	0.001	0.001	-0.000	-0.000	2.919
	(0.44)	(0.24)	(0.27)	(-0.10)	(-0.09)	(0.00)
Adjusted R^2	0.005	0.004	0.011	0.009	0.009	0.004
N	998	1961	1012	2028	2028	2029

Table 5. The Regression of Announcement Period Abnormal Returns (Unexpected dividend increase is defined as dividend surprise divided by previous quarter dividend)

Table 5 reports the regression of announcement period abnormal returns. The announcement period abnormal returns start on the second day before the announcement date and end on the second day after the announcement date. Unexpected dividend increase is defined as dividend surprise divided by previous quarter dividend. Market value of equity/index level is market value of equity (in billions) scaled by the level of the S&P 500 index 5 days prior to the dividend announcement. Dividend yield is defined as the total dividend disbursement during the fiscal year preceding the dividend announcement scaled by the market value of equity 5 days prior to the dividend announcement. Median Tobin's q is determined by fiscal year. Low q firms are defined as those firms which Tobin's q is less than median Tobin's q. Low q x cash flow is an interaction term equal to the product of the dummy variable of Tobin's q and cash flow and so is Low q x cash level. Tobin's q takes on a value 1 if Tobin's q is less than median Tobin's q and 0 otherwise. Cash flow-low q is the cash flow for low q firms. Cash level-low q is the cash level for low q firms. Tax-dummy takes on a value 0 if year is less than 2003 and 1 otherwise. Definitions of the other variables are defined as in Table 1.

Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.002	-0.001	-0.001	-0.001	-0.001	0.001
	(0.40)	(-0.35)	(-0.43)	(-0.49)	(-0.30)	(0.30)
Unexpected	0.004 ***	0.002 ***	0.004 ***	0.002 ***	0.002 ***	0.002 ***
dividend increase	(4.53)	(3.64)	(4.88)	(4.00)	(3.99)	(4.07)
Market value of	-0.138	-0.063 *	-0.111	-0.044	-0.047	-0.053
equity/index level	(-1.31)	(-1.82)	(-1.06)	(-1.31)	(-1.35)	(-1.53)
Dividend yield	0.202 **	0.234 ***	0.226 ***	0.231 ***	0.236 ***	0.215 ***
	(2.28)	(3.38)	(2.74)	(3.50)	(3.50)	(3.20)
Cash flow		0.016				
		(1.10)				
Cash flow-low q	-0.01					
	(-0.30)					
Low q x cash flow		-0.005				
		(-0.22)				
Cash level				0.004 **	0.004 **	
				(2.37)	(2.25)	
Cash level-low q			0.026 **			
			(2.52)			
Low q x cash level				0.022 **	0.023 **	
				(2.18)	(2.15)	
Tobin's q					-0.001	0.000
					(-0.35)	(0.11)
Tax-dummy	-0.000	0.000	-0.001	-0.001	-0.001	-0.000
	(-0.03)	(0.11)	(-0.22)	(-0.26)	(-0.26)	(-0.17)
Adjusted R^2	0.025	0.011	0.034	0.017	0.016	0.012
N	998	1961	1012	2028	2028	2029

Table 6. Changes in Capital Expenditures and R&D Expenses for Low q Firms

Table 6 reports the changes in capital expenditures and R&D expenses standardized by the average of beginning-and ending-period book value of total assets following dividend increase announcements for low q firms over the period 1996 to 2007. Low q firms are those firms whose Tobin's q is smaller than the median. Definition of Tobin's q is as defined in Table 1. Median Tobin's q is determined by fiscal year. Year 0 is the fiscal year in which the dividend increase is announced. The unadjusted change is equal to the change in capital expenditures and R&D expenses. The adjusted change is defined as the difference between a change in capital expenditures and R&D expenses for a sample firm and change in capital expenditures and R&D expenses for a matching firm that has the same two-digit SIC code as the sample firm and the closest change in capital expenditures and R&D expenses to that of the sample firms from fiscal year -2 to fiscal year -1. If no firms meet the criteria, we discard the SIC code to a one-digit SIC. The mean and median changes are calculated by using Winsorized observations at the first and the 99^{th} percentiles. The significance levels of the means (medians) are based on a two-tailed t-test (two-tailed Wilcoxon rank test). Mean (Median) reports t-statistic (p-value). *, **, and *** denote that the statistics differ significantly differ from zero at the 10%, 5%, and 1% levels, respectively.

	Sample firms(unadjusted changes)			Matching firms(unadjusted changes)			Adjusted changes		
	-2 to -1	-1 to 0	0 to 4	-2 to -1	-1 to 0	0 to 4	-2 to -1	-1 to 0	0 to 4
Mean	0.008 ***	0.007 ***	-0.012 ***	0.010 ***	0.029 ***	0.003	-0.002	-0.022 ***	-0.015 **
	(9.37)	(8.86)	(-5.80)	(9.05)	(11.25)	(0.47)	(-1.45)	(-7.94)	(-2.40)
Median	0.005 ***	0.004 ***	-0.006 ***	0.008 ***	0.012 ***	-0.005	-0.003 ***	-0.008 ***	-0.001
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.14)	(0.001)	(<.0001)	(0.38)
N	988	983	350	988	971	348	988	968	345

Table 7. Changes in Capital Expenditures and R&D Expenses for Low q Firms with a Cash-high Level

Table 7 reports the changes in capital expenditures and R&D expenses standardized by the average of beginning-and ending-period book value of total assets following dividend increase announcements for low q firms with a cash-high level over the period 1996 to 2007. Low q firms with a cash-high level are those firms whose Tobin's q is smaller than the median, and whose cash level is greater than the median. Definitions of Tobin's q and cash level are as defined in Table 1. Median is determined by fiscal year. Year 0 is the fiscal year in which the dividend increase is announced. The unadjusted change is equal to the change in capital expenditures and R&D expenses. The adjusted change is defined as the difference between a change in capital expenditures and R&D expenses for a sample firm and change in capital expenditures and R&D expenses for a matching firm that has the same two-digit SIC code as the sample firm and the closest change in capital expenditures and R&D expenses to that of the sample firms from fiscal year -2 to fiscal year -1. If no firms meet the criteria, we discard the SIC code to a one-digit SIC. The mean and median changes are calculated by using Winsorized observations at the first and the 99th percentiles. The significance levels of the means (medians) are based on a two-tailed t-test (two-tailed Wilcoxon rank test). Mean (Median) reports t-statistic (p-value). *, **, and *** denote that the statistics differ significantly differ from zero at the 10%, 5%, and 1% levels, respectively.

	Sample firms(unadjusted changes)			Matching firms(unadjusted changes)			Adjusted changes		
	-2 to -1	-1 to 0	0 to 4	-2 to -1	-1 to 0	0 to 4	-2 to -1	-1 to 0	0 to 4
Mean	0.005 ***	0.008 ***	-0.015 ***	0.006 ***	0.027 ***	0.003	-0.001	-0.019 ***	-0.017 *
	(4.03)	(5.37)	(-4.63)	(3.72)	(6.99)	(0.33)	(-0.46)	(-4.63)	(-1.94)
Median	0.004 ***	0.005 ***	-0.008 ***	0.008 ***	0.012 ***	-0.003	-0.004 **	-0.007 ***	-0.005
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.56)	(0.03)	(0.001)	(0.14)
N	379	375	147	379	371	147	379	369	147

Table 8. Levels of Operating Performance for the Sample

Operating performance is defined as operating income before depreciation, scaled by the average of cash-adjusted assets (book value of assets less cash and short-term investments) at the beginning and end of the fiscal quarter. To reduce the effect of outliners, the observations have been Winsorized at the 1% and 99% of the sample distribution. *, **, and *** denote significance at 10%, 5%, and 1% level, respectively.

	Unadjusted			Industry-adjusted			Performance-adjusted		
Q	N	Mean	Median	N	Mean	Median	N	Mean	Median
-2	1968	0.058 ***	0.05 ***	1407	0.021 ***	0.017 ***	1179	-0.000	0.000
-1	1975	0.059 ***	0.05 ***	1415	0.023 ***	0.017 ***	797	0.002	-0.000 **
0	1966	0.057 ***	0.048 ***	1434	0.021 ***	0.016 ***	1636	0.000	0.000
1	1980	0.056 ***	0.048 ***	1447	0.02 ***	0.015 ***	1595	0.001	0.001 **
2	1974	0.056 ***	0.048 ***	1444	0.02 ***	0.017 ***	1570	0.003 **	0.001 ***
3	1962	0.056 ***	0.049 ***	1439	0.022 ***	0.016 ***	1524	0.006 ***	0.003 ***
4	1940	0.055 ***	0.047 ***	1446	0.019 ***	0.015 ***	1479	0.005 ***	0.002 ***
5	1929	0.055 ***	0.047 ***	1445	0.02 ***	0.015 ***	1482	0.006 ***	0.003 ***
6	1882	0.055 ***	0.047 ***	1436	0.02 ***	0.016 ***	1459	0.007 ***	0.004 ***
7	1781	0.055 ***	0.047 ***	1364	0.02 ***	0.015 ***	1437	0.005 ***	0.001 ***
8	1644	0.057 ***	0.049 ***	1298	0.02 ***	0.015 ***	1460	0.001	0.001 **
12	1356	0.057 ***	0.049 ***	1150	0.021 ***	0.015 ***	1250	0.001	0.000

Table 9. Changes in Operating Performance for the Sample

Operating performance is defined as operating income before depreciation, scaled by the average of cash-adjusted assets (book value of assets less cash and short-term investments) at the beginning and end of the fiscal quarter. To reduce the effect of outliners, the observations have been Winsorized at the 1% and 99% of the sample distribution. *, **, and *** denote significance at 10%, 5%, and 1% level, respectively.

	Unadjusted			Industry-adjusted			Performance-adjusted		
Q	N	Mean	Median	N	Mean	Median	N	Mean	Median
0 to 1	1944	-0.001 **	-0.000	1394	-0.001	-0.001 *	1615	0.001	0.001
0 to 2	1922	-0.000	0.000	1369	-0.001	-0.000 *	1572	0.003 ***	0.002 ***
0 to 3	1887	-0.000	0.001 *	1336	0.000	-0.001	1528	0.005 ***	0.003 ***
0 to 4	1839	-0.002 ***	-0.000 ***	1305	-0.002 ***	-0.001 ***	1484	0.005 ***	0.002 ***
0 to 5	1830	-0.002 ***	-0.001 ***	1298	-0.002 *	-0.001 ***	1484	0.006 ***	0.003 ***
0 to 6	1781	-0.001	0.000 *	1266	-0.001	-0.002 **	1471	0.008 ***	0.004 ***
0 to 7	1697	-0.001	-0.001 ***	1203	-0.001	-0.001 *	1465	0.006 ***	0.002 ***
0 to 8	1589	-0.000	0.000	1158	0.001	0.000	1516	0.001	0.000 **
0 to 12	1267	0.000	0.000	964	0.002	-0.001	1521	0.001	0.000

Table 10. Regression of Earnings Changes Calculated by Using Operating Income before Depreciation on the Normalized Actual Dividend Changes

Table 10 reports the estimates of regression of earnings changes on the normalized actual dividend changes. This table only uses the sample of not having overlap calculations of earning between periods. A period contains some quarters. Period 0 is a period including the normalized actual dividend change. $EBITDA_t$ is the operating income before depreciation in period t. AT_{-1} is the book value of total assets at the end of period -1. $\Delta DIV_0/DIV_{-1}$ is the normalized actual dividend change, where ΔDIV_0 is change in dividend increase in the last quarter of period 0. DIV_{-1} is the previous quarter dividend relative to the change in dividend increase. ROA_0 is defined as the operating income before depreciation in period 0 divided by the total assets at the end of period 0. DFE_0 is equal to ROA_0-E[ROA_0], where E[ROA_0] is the prediction value from the regression of ROA_0 on the logarithm of total assets in period -1, the logarithm of the market-to-book ratio of equity in period -1, and ROA_{-1}. CE_0 is equal to $(EBITDA_0-EBITDA_{-1})/AT_{-1}$. $NDFED_0$ ($PDFED_0$) is a dummy variable that takes the value of 1 if DFE_0 is negative (positive) and 0 otherwise. $NCED_0$ ($PCED_0$) is a dummy variable that takes the value of 1 if CE_0 is negative (positive) and 0 otherwise. For each regression, we reports the coefficients and White's t-statistic. To mitigate the effect of outliners, all the variables, except the log of total assets, have been Winsorized at the 1% and 99% of the sample distribution. *, **, and *** denote significance at 10%, 5%, and 1% level, respectively.

	$(EBITDA_1-EBITDA_0)/AT_{-1}$					
	One year		One and a half years		Two years	
Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-0.036 ***	0.011 ***	0.066 ***	0.014	0.202	0.02
	(-6.49)	(3.495)	(3.863)	(1.322)	(1.313)	(0.205)
$\Delta DIV_0/DIV_{-1}$	0.001 ***	-0.0	0.026 *	0.039	0.033	0.045
	(4.031)	(-0.451)	(0.908)	(1.587)	(0.24)	(0.508)
ROA_0	0.329 ***		-0.186 ***		-0.45	
	(17.255)		(-2.799)		(-0.824)	
DFE_0		-0.796 ***		-0.666		0.999
		(-4.145)		(-1.226)		(0.397)
$NDFED_0$ x DFE_0		0.867 ***		0.508		-2.449
		(2.705)		(0.595)		(-0.513)
$NDFED_0$ x DFE_0^2		1.548		3.375		-2.873
		(1.334)		(0.978)		(-0.242)
PDFED0 x DFE_0^2		7.538 ***		0.866		-6.954
		(6.498)		(0.304)		(-0.701)
CE_0	-0.252 **	0.712 ***	0.508 ***	0.421	0.571	0.463
	(-2.394)	(5.347)	(3.54)	(1.484)	(1.06)	(0.821)
$NCED_0$ x CE_0		-0.485		-1.226		1.44
		(-1.308)		(-1.13)		(0.433)
$NCED_0$ x CE_0^2		0.637 ***		-10.98		26.203
		(7.505)		(-0.808)		(1.133)
$PCED_0$ x CE_0^2		-3.447 ***		0.293		0.012
		(-7.764)		(0.336)		(0.13)
Adjusted R^2	0.906	0.932	0.108	0.183	0.157	0.157
N	1469	1469	957	957	719	719

Table 11. Regression of Earnings Changes Calculated by Using the Operating Income before Depreciation on Unexpected Dividend Changes

Table 11 reports the estimates of regression of earnings changes calculated by using the operating income before depreciation on unexpected dividend changes. This table only uses the sample of not having overlap calculations of earning between periods. A period contains some quarters. Period 0 is a period including the unexpected dividend change. $UEDC_0$ is the unexpected dividend change in the last quarter of period 0, which is the dividend surprise scaled by previous quarter dividend. DPC_0 (DNC_0) is a dummy variable that takes the value 1 for positive unexpected dividend changes (negative unexpected dividend changes) and 0 otherwise. Definitions of the other variables are as defined in Table 10. For each regression, we reports the coefficients and White's t-statistic. To mitigate the effect of outliners, all the variables, except the log of total assets, have been Winsorized at the 1% and 99% of the sample distribution. *, **, and *** denote significance at 10%, 5%, and 1% level, respectively.

	$(EBITDA_1-EBITDA_0)/AT_{-1}$					
	One year		One and a half years		Two years	
Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-0.38 ***	0.011 ***	0.067 ***	0.014	0.195	0.009
	(-6.74)	(3.384)	(3.954)	(1.414)	(1.311)	(0.086)
$UEDC_0$ x DPC_0	0.002	0.002	0.009 *	0.011 **	0.021	0.029
	(1.612)	(1.532)	(1.923)	(2.537)	(0.75)	(1.29)
$UEDC_0$ x DNC_0	-0.002	0.0	0.0	-0.001	-0.012	-0.014
	(-1.64)	(0.532)	(0.017)	(-0.202)	(-0.493)	(-0.659)
ROA_0	0.328 ***		-0.191 ***		-0.464	
	(17.137)		(-2.891)		(-0.859)	
DFE_0		-0.791 ***		-0.663		0.975
		(-4.16)		(-1.218)		(0.389)
$NDFED_0$ x DFE_0		0.879 ***		0.502		-2.381
		(2.774)		(0.584)		(-0.501)
$NDFED_0$ x DFE_0^2		1.604		3.4		-2.63
		(1.398)		(0.978)		(-0.221)
PDFED0 x DFE_0^2		7.535 ***		0.898		-6.925
		(6.514)		(0.316)		(-0.699)
CE_0	-0.254 **	0.691 ***	0.507 ***	0.423	0.571	0.437
	(-2.401)	(5.175)	(3.483)	(1.466)	(1.06)	(0.775)
$NCED_0$ x CE_0		-0.42		-1.427		1.503
		(-1.142)		(-1.314)		(0.45)
$NCED_0$ x CE_0^2		0.648 ***		-13.85		27.051
		(7.716)		(-1.025)		(1.152)
$PCED_0$ x CE_0^2		-3.417 ***		0.28		0.015
		(-7.731)		(0.317)		(0.156)
Adjusted R^2	0.907	0.933	0.112	0.186	0.156	0.157
N	1469	1469	957	957	719	719

Table 12. Regression of Earnings Changes Calculated by Using Earnings before Extraordinary Items on Unexpected Dividend Changes

Table 12 reports the estimates of regression of earnings changes calculated by using earnings before extraordinary items on unexpected dividend changes. This table only uses the sample of not having overlap data calculations of earning between periods. A period contains some quarters. Period 0 is a period including the unexpected dividend change. $UEDC_0$ is the unexpected dividend change in the last quarter of period 0, which is the dividend surprise scaled by previous quarter dividend. DPC_0 (DNC_0) is a dummy variable that takes the value 1 for positive unexpected dividend changes (negative unexpected dividend changes) and 0 otherwise. E_t is the earnings before extraordinary items in period t. B_{-1} is the book value of equity at the end of period -1. ROE_0 is defined as the earnings before extraordinary items in period 0 divided by the book value of equity at the end of period 0. DFE_0 is equal to ROE_0-E [ROE_0], where E[ROE_0] is the prediction value from the regression of ROE_0 on the logarithm of total assets in period -1, the logarithm of the market-to-book ratio of equity in period -1, and ROE_{-1}. CE_0 is equal to $(E_0-E_{-1})/B_{-1}$. Definitions of the other variables are as defined in Table 10. For each regression, we reports the coefficients and White's t-statistic. To mitigate the effect of outliners, all the variables, except the log of total assets, have been Winsorized at the 1% and 99% of the sample distribution. *, **, and *** denote significance at 10%, 5%, and 1% level, respectively.

	$(E_1-E_0)/B_{-1}$					
	One year		One and a half years		Two years	
Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.02 **	0.011 *	0.034 *	0.027 *	-0.198	0.07
	(2.541)	(1.915)	(1.849)	(1.836)	(-0.727)	(0.785)
$UEDC_0$ x DPC_0	0.003 ***	0.006 **	0.015 ***	0.012 **	0.012	-0.014
	(3.013)	(2.453)	(2.848)	(2.484)	(0.309)	(-0.311)
$UEDC_0$ x DNC_0	-0.001	0.001	0.01	0.01	-0.142	-0.126
	(-0.241)	(0.225)	(0.683)	(0.711)	(-1.182)	(-1.018)
ROE_0	-0.005		0.019		0.679	
	(-0.138)		(0.304)		(1.104)	
DFE_0		-0.12		0.021		-0.329
		(-0.767)		(0.093)		(-0.206)
$NDFED_0$ x DFE_0		0.049		-0.275		1.245
		(0.2)		(-0.692)		(0.401)
$NDFED_0$ x DFE_0^2		0.903 **		1.268		9.615
		(2.284)		(1.235)		(1.376)
PDFED0 x DFE_0^2		0.039		-0.04		0.420
		(0.112)		(-0.13)		(0.394)
CE_0	-0.174 ***	-0.053	0.04	-0.09	0.381	-0.122
	(-2.793)	(-0.332)	(0.427)	(-0.538)	(0.803)	(-0.244)
$NCED_0$ x CE_0		0.639 *		1.302 **		5.406
		(1.786)		(2.281)		(1.316)
$NCED_0$ x CE_0^2		5.981 ***		9.666 ***		25.652
		(3.728)		(3.383)		(1.426)
$PCED_0$ x CE_0^2		0.184		0.155		0.053
		(0.361)		(0.924)		(0.536)
Adjusted R^2	0.025	0.098	0.007	0.094	0.037	0.075
N	1813	1813	1257	1257	1058	1058

Table 13. Robustness Checks for the Regression of Announcement Period Abnormal Returns

In model (1) and (2), we compute announcement period abnormal returns using the CRSP daily value weighted index as a proxy for the market index. In model (3) and (4), unexpected dividend change is defined as dividend surprise scaled by the market value of equity 5 days before the dividend announcement. Then the value is multiplied by 100. In model (5) and (6), Tobin's q is defined as the ratio of firm market value (defined as the book value of total assets minus the book value of equity plus the market value of equity) to the book value of assets. Definitions of the other variables are as defined in Table 5. *, **, and *** denote significance at 10%, 5%, and 1% level, respectively.

Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-0.001	-0.000	0.001	0.000	-0.003	-0.001
	(-0.19)	(-0.07)	(0.28)	(0.14)	(-0.89)	(-0.54)
Dividend surprise/ previous quarter dividend	0.004 ***	0.002 ***			0.003 ***	0.002 ***
	(5.20)	(4.33)			(3.71)	(4.42)
Dividend surprise/ equity value			0.009 ***	0.011 ***		
			(3.56)	(5.01)		
Market value of equity/Index	-0.104	-0.043	-0.190 *	-0.044	0.073	-0.011
	(-0.99)	(-1.30)	(-1.83)	(-1.31)	(1.56)	(-0.39)
Dividend yield	0.237 ***	0.243 ***	0.151 *	0.155 **	0.190 ***	0.243 ***
	(2.90)	(3.73)	(1.78)	(2.33)	(2.58)	(3.76)
Cash level		0.005 **		0.004 **		0.005 **
		(2.56)		(2.41)		(2.49)
Cash level_low q	0.020 **		0.024 **		0.019 *	
	(1.96)		(2.36)		(1.71)	
Lowq x cash level		0.016		0.019 *		0.012
		(1.58)		(1.89)		(1.07)
Tax_dummy	-0.003	-0.003	-0.000	-0.002	0.000	-0.001
	(-0.88)	(-1.19)	(-0.14)	(-0.73)	(0.05)	(-0.47)
Adjusted R^2	0.035	0.018	0.023	0.021	0.017	0.015
N	1012	2028	1012	2028	1058	2111

Table 14. Robustness Checks for Changes in Capital Expenditures and R&D Expenses of Low q Firms

Table 14 reports robustness checks for changes in capital expenditures and R&D expenses of low q firms. Changes in capital expenditures and R&D expenses are standardized by the average of beginning- and ending-period book value of total assets. Tobin's q is defined as the ratio of firm market (defined as the book value of total assets minus the book value of equity plus the market value of equity) to the book value of assets. Low q firms are those firms whose Tobin's q is smaller than the median. Low q firms with a cash-high level are those firms whose Tobin's q is smaller than the median, and whose cash level is greater than the median. Median is determined by fiscal year. Definition of cash level is as defined in Table 2. Year 0 is the fiscal year in which the dividend increase is announced. The mean and median changes are calculated by using Winsorized observations at the first and the 99th percentiles. The significance levels of the means (medians) are based on a two-tailed t-test (two-tailed Wilcoxon rank test). Mean (Median) reports t-statistic (p-value). *, **, and *** denote significance at 10%, 5%, and 1% level, respectively.

Panel A.: Changes in Capital Expenditures and R&D Expenses for Low q Firms

	Sample firms(unadjusted changes)			Matching firms(unadjusted changes)			Adjusted changes		
	-2 to -1	-1 to 0	0 to 4	-2 to -1	-1 to 0	0 to 4	-2 to -1	-1 to 0	0 to 4
Mean	0.009 ***	0.008 ***	-0.010 ***	0.011 ***	0.028 ***	-0.001	-0.002	-0.02 ***	-0.008 **
	(9.87)	(8.99)	(-4.74)	(9.53)	(9.71)	(-0.20)	(-1.44)	(-6.74)	(-1.44)
Median	0.005 ***	0.004 ***	-0.005 ***	0.008 ***	0.010 ***	-0.005	-0.003 ***	-0.006 ***	0.000
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.14)	(0.001)	(<.0001)	(0.67)
N	1030	1026	363	1030	1018	363	1030	1015	363

Panel B.: Changes in Capital Expenditures and R&D Expenses for Low q Firms with a Cash-high Level

	Sample firms(unadjusted changes)			Matching firms(unadjusted changes)			Adjusted changes		
	-2 to -1	-1 to 0	0 to 4	-2 to -1	-1 to 0	0 to 4	-2 to -1	-1 to 0	0 to 4
Mean	0.007 ***	0.009 ***	-0.011 ***	0.007 ***	0.033 ***	-0.009	-0.001	-0.025 ***	-0.002
	(4.60)	(5.15)	(-3.24)	(4.17)	(6.82)	(-0.96)	(-0.33)	(-4.76)	(-0.17)
Median	0.004 ***	0.005 ***	-0.007 ***	0.007 ***	0.012 ***	-0.006	-0.003 *	-0.008 ***	-0.001
	(<.0001)	(<.0001)	(0.004)	(<.0001)	(<.0001)	(0.21)	(0.09)	(<.0001)	(0.80)
N	354	351	134	354	348	136	354	346	134