Dividend Changes and Future Profitability:

The role of earnings volatility

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Abstract

We investigate whether dividend changes signal changes in a firm's future profitability by also considering the firm's earnings volatility. In general, we find a positive relation between dividend increases and future earnings, so dividend increases tend to signal positive changes in future earnings. However, this positive relation is strongly affected by the firm's earnings volatility, such that higher earnings volatility reduces the positive effect of dividend increases on future earnings. Specifically, for firms with high earnings volatility, dividend increases signal a reduction in future earnings volatility instead of an increase in future earnings. On the other hand, we do not find corresponding results for dividend decreases. Our findings have three main implications: 1) The traditional dividend signaling theory is valid. 2) The effect of signaling depends on a firm's earnings volatility. 3) For high-volatility firms, positive dividend changes signal earnings volatility reductions rather than earnings increases.

JEL Classification: G17, G30, G35

Key Words: Dividends, Signaling, Earnings volatility

1 Introduction

Market reactions to dividend changes are well documented in the finance literature. Dividend initiations and increases are typically accompanied by positive stock price reactions, while dividend omissions and cuts are met with negative market reactions (Pettit, 1972; Charest, 1978; Aharony and Swary, 1980; Brickley, 1983; Healy and Palepu, 1988; Michaely, Thaler, and Womack, 1995). To explain this empirical finding, theory proposes that changes in dividend policy could act as a signaling device to the general market regarding a firm's future prospects (Bhattacharya, 1979; John and Williams, 1985; Miller and Rock, 1985).

Whether dividend changes forecast longer term effects on future profitability, as suggested by the traditional dividend signaling hypothesis, is still unclear. Nissim and Ziv (2001) use a linear model of earnings expectations to find that dividend increases are positively associated with future earnings. However, Grullon, Michaely, and Thaler (2005) use a similar model that incorporates nonlinearity in earnings expectations, and they find no evidence that dividend increases signal increases in future earnings. These mixed results raise questions about the validity of the dividend signaling hypothesis.

Prior studies look into the direct relation between dividend changes and changes in future earnings. According to the signaling models developed by Lintner (1956) and Bhattacharya (1979), earnings volatility could distort the direct relation between dividend changes and future profitability, thereby leading to ambiguous empirical results in tests that focus exclusively on a direct relation. We hypothesize that there is a positive association between changes in dividends and future profitability; however, this association is conditional on a firm's earnings volatility. In particular, the positive association between dividend increases and future earnings changes is reduced by higher current earnings volatility, ceteris paribus. Accordingly, for firms with high earnings volatility, a dividend increase could signal a reduction in future earnings volatility rather than (or in addition to) an increase in future earnings, but for firms with low earnings volatility, a dividend increase should signal higher future earnings, since earnings volatility is bounded at zero. However, a dividend decrease could signal either lower future earnings or higher future earnings volatility, regardless of the level of current earnings volatility.

We first adopt methodologies similar to Nissim and Ziv (2001) and Grullon et al. (2005), modified by considering current earnings volatility. We use both linear and nonlinear models in order to test whether our results are robust to different assumptions about earnings expectations. Our results provide strong evidence that increases in dividends have a positive association with future earnings profitability. However, earnings volatility mitigates this signaling effect. Specifically, we find that for firms with low earnings volatility, a dividend increase signals an increase in future earnings; whereas for firms with high earnings volatility, a dividend increase signals a reduction in future earnings volatility rather than changes in earnings. As expected, and consistent with previous literature, we do not find conclusive results regarding dividend decreases. Our evidence suggests that firms might also change their dividend policies due to an expected change in future earnings volatility: Dividend increases are associated with a reduction in future earnings volatility, and this reduction is even stronger for firms with high current earnings volatility. Therefore our findings provide an important reconciliation of the inconsistent results regarding the information content of dividend changes that have been reported in the previous literature.

We make at least three important contributions to the finance literature. First, we find new and consistent evidence that supports the traditional dividend signaling theory based on two previous empirical models that generate contradictory results. Thus, our results are robust to different earnings expectations models and specifications. Second, we are the first to investigate the how earnings volatility affects dividend changes signal future earnings performance. Third, our findings imply that dividend changes signal not only the future expected level of earnings, but also the expected volatility of earnings, such that dividend increases signal an expected volatility reduction for high-volatility firms.

The rest of the paper is organized as follows. Section 2 reviews the previous literature and develops our hypotheses. Section 3 describes our data and methodologies. Empirical results are discussed in Section 4. Section 5 presents robustness tests. Finally, Section 6 concludes the paper.

2 Literature and Hypotheses

2.1 The traditional dividend signaling hypothesis

Miller and Modigliani (1961) contend that, in perfect and complete capital markets, a firm's dividend policy should be irrelevant to firm value and investors' positions. Subsequently, many hypotheses have been raised to rationalize dividend paying behavior when various market imperfections are present. Some researchers propose that firms pay dividends as a signaling device to outside investors, when information asymmetries exist. Bhattacharya (1979), John and Williams (1985) and Miller and Rock (1985) demonstrate that changes in dividends, acting as costly and therefore credible signaling tools, could be used by insiders to intentionally convey information about a firm's future prospects without having to reveal sensitive, verifiable information that could jeopardize the firm's competitive advantage.[1]

[1] There are two main strands of literature that empirically investigate the signaling content of dividends. The first looks at stock price reaction. It is well documented that the market reacts positively to dividend increases and negatively to dividend decreases (Pettit, 1972; Charest, 1978; Aharony and Swary, 1980; Brickley, 1983; Healy and

Signaling theory dictates that dividend changes should be costly to in order to be credible. Bhattacharya (1979) considers transaction costs of having to resort to relatively expensive outside financing when new capital has to be raised as a result of the increased dividend payment as the primary signaling costs, whereas Miller and Rock (1985) suggest that the opportunity cost associated with the cash outflows of dividend payment is the major signaling cost. The signaling model developed by John and Williams (1985) considers taxes as the primary cost for dividend signaling. The primary benefit is a lower cost of capital associated with an increased share price. Such costs are greater and benefits are less for firms with poorer future prospects, so dividend signaling would yield a net loss for firms without sufficiently positive future prospects, but it could yield a net benefit for others.

Another aspect of signaling costs could be tied to earnings volatility. Based on interviews with top executives and directors of 28 firms, Lintner (1956) suggests that most firms have a target payout ratio, and they adjust their dividends to earnings only when management believes earnings have increased permanently. He further states that most firms take a slow process to adjust their dividends as they believe the market favors a stable dividend policy. His work implies that dividend decisions are a function of the firm's target payout ratio and the speed of adjustment of current dividends to the target ratio.

One important implication of Linter's research is that the volatility of earnings, while not formally addressed in his paper, could factor into the speed of adjustment (Fama and Babiak, 1968). Bhattacharya's (1979) model explicitly takes earning volatility into account: In an imperfect information setting, dividend changes reflect expected future cash flows and expected future cash flow volatility. Bradley, Capozza, and Seguin (1998, p. 555) argue "given the existence of a

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Palepu, 1988; Michaely, Thaler, and Womack, 1995). The second strand looks at future profitability, which is our focus.

stock-price penalty associated with dividend cuts, managers rationally pay out lower levels of dividends when future cash flows are less certain." They find that firms with higher expected cash flow volatility have lower payout ratios compared to firms with lower expected volatility. In a cross-country analysis, Chay and Suh (2009) also document the significance of cash-flow uncertainty in determining corporate payout policy.

Several quantitative studies have been conducted to empirically test the relation between dividends and profitability. Watts (1973) finds an insignificant effect from dividend changes on next year's earnings. Similarly, Penman (1983) finds that dividend changes contain little information and many firms do not adjust their dividend policy even though improved future earnings are expected. His findings suggest that expected future profitability might not be the only consideration firms have when it comes to dividend policy changes. Benartzi, Michaely, and Thaler (1997) find a strong association between dividend changes and contemporaneous earnings changes, but fail to find evidence of any relation between dividend changes and future earnings changes. They maintain that the predictive value of dividend changes is minimal, such that dividends reflect the past rather than signal the future. Their findings were later confirmed by Grullon, Michaely, and Swaminathan (2002).

On the other hand, Brickley (1983) finds that earnings increase significantly in the same year as dividends increase, as well as in the following year, albeit using a small and restricted sample. Focusing on extreme situations of dividend initiations and omissions, Healy and Palepu (1988) find that dividend initiations are generally followed by rapidly increasing earnings for two years. For dividend omissions, they find that earnings decline in the year of the announcement, but then increases in later years.

Nissim and Ziv (2001) find a positive relation between dividend increases and future earnings changes, future abnormal earnings, and future profitability levels in each of the two years following a dividend increase. They find no relation between dividend decreases and future profitability. They attribute this to the accounting concept of conservatism that "losses should be recognized in earnings when anticipated whereas profits should be recognized only when earned" (p.2126). Their findings were later contested by Grullon et al. (2005) who argue Nissim and Ziv's assumption of linear earnings expectations is inappropriate and the results obtained under this false assumption are biased. They further develop a model using Fama and French's (2000) modified partial adjustment model that assumes nonlinearity in earnings expectations and find no relation between dividend changes and future profitability.

2.2 Hypothesis development

The signaling model by Lintner (1956) suggests that dividend payments depend largely on stable and sustainable earnings and firms would change their dividend policy in response to changes in the predictability of future earnings. The confidence of future earnings relies on not only the magnitude of expected futures earnings but also the volatility of the earnings. Bhattacharya (1979) also proposes that dividend changes are a function of expected future cash flows and expected cash flow volatility. Therefore, we propose a modification of the classical dividend signaling hypothesis such that current dividend changes are not only associated with expected future earnings, but also with the expected volatility of these earnings.

Consider the following example of two dividend-paying firms, Firm A and Firm B. Suppose the two firms have exactly the same payout ratios (50%), current dividend per share ($0.5), current earnings per share (EPS) ($1), and expected EPS in the next period ($2). The only difference between Firm A and Firm B is their future earnings volatilities next period: Firm A has a 50% probability of obtaining earnings of $1 per share and a 50% probability of obtaining $3 per share, and Firm B has a 100% probability of obtaining $2 per share in the following period. Assume that both firms signal the market about future earnings by adjusting their dividend payments based on their payout ratios and expected earnings. If we neglect the difference in their earnings volatilities, it may appear that both firm A and firm B should increase their dividends from $0.5 to $1. However, because Firm A has 50% probability of having EPS $1, it may postpone its dividend adjustment to avoid having to reduce its dividend in the future should the less favorable scenario occur. Lintner (1956) suggests that firms may partially adjust their dividends to earnings, in order to shield them from future uncertainty.

Now suppose for the period following the next, firm A's EPS is expected to stay the same at $2. However, this time assume that there is no uncertainty associated with it: Firm A has a 100% probability of obtaining $2 per share. In this case, Firm A should adjust its dividend from $0.5 to $1, even though the expected earnings stay the same as the previous period. This example illustrates that two firms with same expected earnings can have different dividend policies if they have different volatilities of future earnings. Firms might adjust their dividend policy as a result of a change in (expected) earnings volatility rather than in expected earnings level. As a result, expected future earnings changes alone might not be sufficient, or even necessary, to trigger dividend changes. It is the combination of expected future earnings and earnings volatility that motivates the change in dividends, which provides one potential explanation of why Grullon et al. (2005), who only look at the direct relation between dividend changes and future earnings changes, fail to support the signaling hypothesis. The direct relation between dividend changes and future earnings may appear weak if many of the dividend increases arise from reduced future earnings volatility.[2]

Lintner (1956) and Bhattacharya (1979) predict that firms with higher earnings volatility are more reluctant to increases dividends, ceteris paribus. For those firms, an increase in dividends could result from an expected decrease in earnings volatility rather than an expected increase in future profitability levels. On the other hand, for firms with low earnings volatility, dividend increases would more likely signal increases in future profitability, since volatility is bounded at zero. However, a dividend decrease does not necessarily indicate a decrease in future earnings. It is possible that the dividend decrease results from an expected rise in future earnings volatility, which could happen even if volatility is already high.

To conclude, firms would increase their dividends if there is no change in expected earnings but a decrease in (expected) earnings volatility, there is an increase in expected earnings and no change in (expected) earnings volatility, or there is a combination of both changes in expected future earnings and future earnings volatility. Expected earnings and earnings volatility interact with each other, and they simultaneously influence dividend changes set by management. Moreover, the interaction suggests that the effect of dividend changes on predicting future profitability should be moderated by earnings volatility. Hence, we hypothesize the following:

Hypothesis 1a: *Dividend increases are positively associated with future earnings changes, ceteris paribus.*

Hypothesis 1b: *The positive association between dividend increases and future earnings changes is mitigated by higher current earnings volatility, ceteris paribus.*

Hypothesis 2a: *Dividend increases are negatively associated with future earnings volatility changes, ceteris paribus.*

[2] Note that both increased expected cash flows and reduced cash flow risk should lead to increased present value, so a dividend increase should lead to an increase in stock price for both signaling effects.

Hypothesis 2b: *The negative association between dividend increases and future earnings volatility changes is stronger for higher current earnings volatility, ceteris paribus.*

Firms could reduce their dividends as a result of an increase in future earnings volatility regardless of current volatility levels. As a result, negative dividend changes can signal either lower future earnings or higher future earnings volatility in all cases. This could be one reason why previous studies fail to find consistent results regarding dividend decreases. Although we do not have a conclusive prediction for dividend decreases, following the literature we still include those observations in our tests.[3]

3 Data and Methodology

3.1 Data and sample selection

Using the Centre for Research in Security Prices (CRSP) monthly event files, we identify dividend events of non-financial firms that trade on the New York Stock Exchange, American Stock Exchange, or NASDAQ Stock Market for at least two years during the period from 1975 to 2005 inclusive.[4,5] Following Nissim and Ziv (2001) and Grullon et al. (2005), we exclude cases of dividend initiations and omissions, as these extreme and sudden changes in payout policies may have different links to future profitability compared to dividend increases or decreases. We also exclude events like special dividends, stock dividends, and stock repurchases. We only consider

[3] In unreported regressions, we also test our models using only dividend increases and no-change events. The regression results are similar to those obtained when dividend decreases are included.

[4] Due to missing quarterly data from Compustat, and the rolling method for constructing earnings volatility, the earliest earnings volatility we can compute is in 1975. We do not include observations after 2005 because of the global financial crisis. Dividends are supposed to signal expected changes; however, wide spread shocks disconnect actual earnings and volatility changes from expected ones, and therefore distort the signaling effects. Nissim and Ziv (2001) and Grullon et al. (2005) use dividend change events from 1963-1997.

[5] Following Nissim and Ziv (2001) and Grullon et al. (2005), we only exclude financial firms from our sample (SIC 6000-6999). However, our results are robust when both financial firms and utility firms (SIC 4900-4999) are excluded.

regular quarterly recurring cash dividends (code 1232) that satisfy the following criteria: 1) The firm's annual fundamentals are available in the Compustat monthly updates database. 2) The firm paid four quarterly dividends in at least two consecutive years. 3) No other distribution announcements were made between the declaration of the previous dividend and four days after the declaration of the current dividend. 4) There were no ex-distribution dates between the ex-distribution dates of the previous and current dividends.

Following Nissim and Ziv (2001) and Grullon et al. (2005), we calculate our main test variable the annual dividend change $R\Delta Div_t$ of a specific fiscal year *t* as the annualized growth rate of quarterly dividend changes $R\Delta Div_{t,q}$:[6]

$$R\Delta Div_t = (1+R\Delta Div_{t,1})(1+R\Delta Div_{t,2})(1+R\Delta Div_{t,3})(1+R\Delta Div_{t,4})-1,$$
$$R\Delta Div_{t,q} = \frac{Div_{t,q}-Div_{t,q-1}}{Div_{t,q}}, \quad (1)$$
$$Div_{t,0} = Div_{t-1,4}.$$

The resulting sample contains 36,742 firm-year observations: 1,307 dividend decreases, 15,207 dividend increases, and 20,228 no-change observations.[7]

Our main dependent variable is the change in future earnings. This variable is constructed as the annual change in earnings before extraordinary items in year τ relative to the dividend event year (year 0) deflated by the book value of equity at the beginning of the announcement year (year -1):

$$\Delta E_\tau = \frac{E_\tau - E_0}{B_{-1}}. \quad (2)$$

[6] These represent firm-level observations. Since there is no risk of confusion, we suppress the usual firm subscript *i*.
[7] Throughout the paper we winsorize the dependent and independent variables at the 1st and 99th percentiles of the empirical distribution. We find similar results with trimming instead of winsorizing.

Since market value of equity may reflect expectations about future earnings, we scale by the previous year's book value of equity as in Nissim and Ziv (2001) and Grullon et al. (2005).

Our other main variable is earnings volatility (EV). Since dividend increases could reflect reductions in volatility, which would be more likely if volatility was high, we expect earnings volatility to moderate the effect of dividend increases on earnings changes. Earnings volatility is constructed as the standard deviation of quarterly earnings before extraordinary items scaled by the book value of total assets over a five-year rolling period. We adjust them to their particular industries by calculating the ratio of earnings volatilities to industry averages based on 2-digit SIC codes. To investigate how dividend changes affect future earnings volatility, we consider the five year ahead change in earnings volatility:

$$\Delta EV_5 = EV_5 - EV_0. \qquad (3)$$

Summary statistics of these variables are included in Table 1.

Insert Table 1 about here

For firms that increase their dividends, the average changes in earnings are 1.0% and 1.3% for each of the two years following dividend event years. Firms that have no change in policy show earnings changes of 0.7% and 1.0%, which are smaller than firms that increase their dividends. For firms that have negative dividend changes, their earnings on average grow at 2.4% and 1.5% following the dividend event. This result contradicts the predictions of the traditional dividend signaling theory as negative dividend changes should be accompanied by unfavorable future prospects. Additionally, the average earnings volatility for dividend increasing firms is 0.858, whereas it is 1.234 and 1.062 for dividend decreasing firms and no-change firms respectively. This result implies that firms with negative dividend changes have the most volatile earnings, while firms with positive dividend changes have the smallest earnings volatility. The average five-year changes in adjusted earnings volatility following a dividend change event for the three groups are 0.128 (increase), -0.120 (decreases) and 0.088 (no-change), which indicates that future earnings volatility of firms that have positive or zero dividend changes increases on average, while that of dividend decreasing firms decreases.

3.2 Methodology

3.2.1 Dividend increases and changes in future earnings

To test Hypotheses 1a and 1b, we regress changes in future earnings on dividend changes, while controlling for expected earnings, current earnings volatility, and the interaction of current earnings volatility and dividend changes. As literature suggests that the relation between dividend changes and earnings changes are asymmetrical for dividend increases and decreases, we allow separate coefficients for dividend increases and decreases. If a firm's earnings process followed a random walk possibly with drift, then we would need no further controls. However, earnings tend to exhibit mean reversion (Fama and French, 2000), so expected future earnings changes could depend on the current level and the rate of change. Scaling by book equity these become return on equity (ROE) and DE_0 respectively. We consider two models to account for these factors: 1) Following Nissim and Ziv (2001) we operationalize these as linear control variables in the regression equation. 2) Following Grullon et al. (2005) we use non-linear functions of the difference between actual and expected current ROE and current earnings changes that include squared terms and different rates of reversion for positive and negative deviations. We provide both the base models and the modified models that include earnings volatility.

The base linear model corresponds to Equation (3) of Nissim and Ziv (2001):

$$\Delta E_{\tau} = \beta_0 + \beta_{1P} DPC_0 \times R\Delta Div_0 + \beta_{1N} DNC_0 \times R\Delta Div_0 + \beta_2 ROE_{\tau-1} + \beta_3 \Delta E_0 + \varepsilon_{\tau}, \qquad (4)$$

where ΔE_{τ} is the annual change in earnings before extraordinary items in year τ relative to the dividend event year (year 0) deflated by the book value of equity at the beginning of the announcement year (year -1). As management's estimates of future earnings are not observable, actual future earnings are used to proxy expectations. DPC and DNC are dummy variables that indicate a dividend increase or decrease respectively. RΔDiv0 is the annual dividend change. The linear model of earnings expectations includes return on equity $ROE_{\tau-1}$ to account for the level of earnings and ΔE_0 to account for the rate of change. Nissim and Ziv (2001) find a positive and significant β_{1P}, which suggests that there is a positive relation between dividend increases and future earnings increases. Our modified linear model is specified as:

$$\begin{aligned}\Delta E_\tau &= \beta_0 + DPC_0 \times (\beta_{1P} R\Delta Div_0 + \beta_{2P} EV_0 + \beta_{3P} R\Delta Div_0 \times EV_0) \\ &+ DNC_0 \times (\beta_{1N} R\Delta Div_0 + \beta_{2N} EV_0 + \beta_{3N} R\Delta Div_0 \times EV_0) \\ &+ \beta_4 ROE_{\tau-1} + \beta_5 \Delta E_0 + \varepsilon_\tau,\end{aligned} \tag{5}$$

where EV_0 is the industry-adjusted earnings volatility.

The base nonlinear model corresponds to Equation (3) of Grullon et al. (2005):

$$\begin{aligned}\Delta E_\tau &= \beta_0 + \beta_{1P} DPC_0 \times R\Delta Div_0 + \beta_{1N} DNC_0 \times R\Delta Div_0 \\ &+ (\gamma_1 + \gamma_2 NDFED_0 + \gamma_3 NDFED_0 \times DFE_0 + \gamma_4 PDFED_0 \times DFE_0) \times DFE_0 \\ &+ (\lambda_1 + \lambda_2 NCED_0 + \lambda_3 NCED_0 \times CE_0 + \lambda_4 PCED_0 \times CE_0) \times CE_0 + \varepsilon_\tau,\end{aligned} \tag{6}$$

where ΔE_τ, DPC_0, DNC_0, and $R\Delta Div_0$ are the same as those previously defined for the linear model. Other variables in the model are proposed by Fama and French (2000) to capture the nonlinearities in mean reversion and autocorrelation in earnings expectations. DFE_0 denotes ROE_0 – $E[ROE_0]$, where $E[ROE_0]$is calculated as the fitted value from the annual cross-sectional regressions of ROE_0 on the natural logarithm of the book value of total assets in year -1, the natural logarithm of the market to book ratio in year -1, and the return on equity in year -1 relative to the dividend event year. $NDFED_0$ and $PDFED_0$ are dummy variables that indicate if DFE_0 is negative or positive respectively. CE_0 is the earnings change in the dividend event year deflated by the book value of common equity in year -1. In particular, ΔE_0 of Equations (4) and (5) are equivalent to CE_0 of Equations (6) and (7). $NCED_0$ and $PCED_0$ are dummy variables that indicate if CE_0 is negative or positive respectively. Grullon et al. (2005) estimate Equation (3), but they find β_{1P} and β_{1N} to be insignificant, contrary to the traditional dividend signaling hypothesis.[8] Our modified nonlinear model is specified as:

$$\begin{aligned}\Delta E_\tau = {} & \beta_0 + DPC_0 \times (\beta_{1P} R\Delta Div_0 + \beta_{2P} EV_0 + \beta_{3P} R\Delta Div_0 \times EV_0) \\ & + DNC_0 \times (\beta_{1N} R\Delta Div_0 + \beta_{2N} EV_0 + \beta_{3N} R\Delta Div_0 \times EV_0) \\ & + (\gamma_1 + \gamma_2 NDFED_0 + \gamma_3 NDFED_0 \times DFE_0 + \gamma_4 PDFED_0 \times DFE_0) \times DFE_0 \\ & + (\lambda_1 + \lambda_2 NCED_0 + \lambda_3 NCED_0 \times CE_0 + \lambda_4 PCED_0 \times CE_0) \times CE_0 + \varepsilon_\tau .\end{aligned} \tag{7}$$

In both Equations (5) and (7), we expect β_{1P} to be positive and β_{3P} to be negative. A positive β_{1P} value indicates that dividend increases are positively associated with future earnings changes, and a negative β_{3P} value shows that the positive relation is mitigated by earnings volatility. For dividend decreases, we do not have strong expectations regarding the signs of the coefficients.

In order to verify that Nissim and Ziv's (2001) and Grullon et al.'s (2005) results still hold in our sample and to make our results comparable to theirs, we first test all four models by using the two-stage procedure proposed by Fama and MacBeth (1973), which is adopted by both of the two mentioned studies. Apart from Fama-MacBeth's two-stage procedure, we also use Rogers standard errors clustered by firms to account for the residual dependence generated by firm effects and control for year fixed effects (Petersen, 2009).

[8] With the exception of our shorthand for earnings changes ΔE and earnings volatility EV, all other variable names are taken from Nissim and Ziv (2001) and Grullon et al. (2005).

3.2.2 Dividend increases and changes in future earnings for high earnings volatility

Equations (5) and (7) test whether earnings volatility affects the relation between dividend increases and changes in future earnings. However, they do not allow us to determine whether high earnings volatility completely eliminates the dividend signaling effect on future earnings. We investigate this question by replacing industry adjusted earnings volatility (EV) in Equations (5) and (7) by a dummy variable (DHEV) indicating that industry adjusted earnings volatility is in the top quartile by firm years. Thus we can employ an F test based on the sum of coefficients β_{1P} and β_{3P} to determine the signaling effect of dividend increases on future earnings for high volatility firms. For completeness we also consider low volatility firms by constructing a similar dummy variable (DLEV) that indicates firms in the bottom quartile of industry adjusted earnings volatility.[9]

3.2.3 Dividend increases and changes in future earnings volatility

To investigate the behavior of future earnings volatilities following dividend changes in high/low-volatility firms, we examine the changes in earnings volatility, pre- and post- dividend. We therefore test the following model:[10]

$$\begin{aligned} \Delta EV_5 = \beta_0 &+ DPC_0 \times (\beta_{1P} R\Delta Div_0 + \beta_{2P} DHEV_0 + \beta_{3P} R\Delta Div_0 \times DHEV_0) \\ &+ DNC_0 \times (\beta_{1N} R\Delta Div_0 + \beta_{2N} DHEV_0 + \beta_{3N} R\Delta Div_0 \times DHEV_0) \\ &+ \varphi_1 EV_0 + \varphi_2 MB_{-1} + \varphi_3 SIZE_{-1} + \varphi_4 LEV_{-1} + \varepsilon_\tau . \end{aligned} \tag{8}$$

$\Delta EV_5 = EV_5 - EV_0$ is the five year change in industry adjusted earnings volatility following the dividend event.[11] We include current earnings volatility EV_0 to control for the inter-temporal

[9] In our tabulated results, we calculate quartiles based on the full sample period. For robustness, in untabulated results, we also calculate quartiles for each year. The results are similar.

[10] For completeness, we also include the dummy variable indicating low industry adjusted earnings volatility DLEV.

[11] For robustness, in untabulated results we also test three-year changes in industry adjusted earnings volatility ΔEV_3. The findings are consistent as those for five year changes.

persistence of earnings volatility. Following Campbell, Lettau, Malkiel and Xu (2001) and Pastor and Veronesi (2003), we also include several firm characteristics to control for the expected volatility change. We control for firm performance and stage of growth, measured by MB_{-1}. We expect its coefficient to be positive as future earnings of growth firms are expected to be more volatile. We include firm size $SIZE_{-1}$ as measured by total assets. Since large firms are normally more stable than small firms in terms of future earnings, we expect its coefficient to be negative. We also control for leverage LEV_{-1}, defined as the ratio of total long term debt to book value of total assets. We expect the coefficient for LEV_{-1} to be negative as higher leverage restrains firms from taking more risky projects and thus lead to more stable future earnings. Other variables are the same as previously defined.

4 Empirical Results

4.1 Dividend increases and changes in future earnings

We first test our regression models by using the two-stage Fama-MacBeth procedure, which is adopted by both Nissim and Ziv (2001) and Grullon et al. (2005). We test both the linear models and the nonlinear models with and without considering earnings volatility. To be consistent with the literature, we examine the association between dividend changes and the changes in earnings in each of the two years following the dividend change.

Table 2 shows the regression results of future earnings changes on dividend changes from the linear models Equations 4 and 5 (based on Nissim and Ziv, 2001) using the Fama-MacBeth procedure. To better observe the effect of earnings volatility on the relation between dividend changes and earnings changes, we present both the results of the base model (Columns 1 and 2) and those of the modified model that includes earnings volatility (Columns 3 and 4).

Insert Table 2 about here

We observe that the coefficients β_{1P} are positive in each specification, implying a positive association between dividend increases and future earnings changes, consistent with Hypothesis 1a. However, the converse relation does not apply to dividend decreases. The coefficients for dividend increases are larger in Columns 3 and 4 when we control for earnings volatility (0.077 and 0.070 compared to 0.039 and 0.041). These results are also economically meaningful, as a one standard deviation increase in dividends increases future earnings by up to 1.1 percent. Consistent with Hypothesis 1b, the coefficients for the interaction between positive dividend changes and earnings volatility, which tests the effect of earnings volatility on dividend signaling, are negative (-0.052 and -0.069) for both one and two year horizons. In addition, the coefficients for earnings volatility levels are also positive and significant (0.008 and 0.013 for $\tau = 1$ and $\tau = 2$ respectively), implying a positive direct association between current earnings volatility and future earnings changes. For dividend decreases, although the coefficients for dividend changes are insignificant for both years, the interaction between dividend decreases and earnings volatility is positive for the second year.[12]

We also find that return-on-equity $ROE_{\tau-1}$ is negatively related to earnings changes, which is expected, because ROE is mean-reverting (Freeman, Ohlson, and Penman, 1982). The negative coefficient for previous earnings change ΔE_0 also implies a negative autocorrelation in the earnings change process.

Table 3 reports the regression results of future earnings changes on dividend changes from the nonlinear models Equations 6 and 7 (based on Grullon et al., 2005) using the Fama-MacBeth procedure. Consistent with Grullon et al. (2005), the results of the base model (Col-

[12] Since we're considering dividend decreases, RΔDiv is negative. Since EV is positive by construction, the product RΔDiv*EV is negative, so a positive coefficient implies a reduction in ΔE following a dividend decrease.

umns 1 and 2) show no relation between dividend changes and earnings changes. All coefficients associated with dividend increases and decreases are insignificant, suggesting that dividend changes do not provide relevant information regarding future earnings without further considering earnings volatility.

Insert Table 3 about here

For the modified model (Columns 3 and 4), we observe a positive relation between dividend increases and earnings changes for the first year following the dividend event year, with a coefficient of 0.068 for dividend increases. This relation is not present in the base model regressions that neglect the effect of earnings volatility on dividend signaling. Moreover, the coefficient for the interaction between dividend increases and earnings volatility for year 1 is negative (-0.053), so including the effects of earnings volatility is necessary for dividend increases to signal future earnings increases. These observations are also consistent with Hypotheses 1a and 1b. However, the coefficients for dividend increases and the interaction term are insignificant for the second year following the dividend increase year, suggesting that dividend increases convey little information regarding longer term profitability.[13] As with the linear model (and previous literature) we find no evidence of dividend signaling for dividend decreases in the first year; although as with the modified linear model, there is a positive relation between the interaction between dividend decreases and earnings volatility and earnings changes for the second year following the dividend decrease. Future earnings changes are related to earnings volatility levels for both year 1 and year 2.

Table 4 reports the regression results of future earnings changes on dividend changes from the nonlinear models Equations 6 and 7 (based on Grullon et al., 2005) using Rogers stand-

[13] Alternatively, it may suggest that actual earnings are not a good proxy for expected earnings as the time horizon increases.

ard errors clustered by firms to control fixed firm effects instead of the Fama-MacBeth procedure (Petersen, 2009).[14] We also use year dummies to control for possible time effects. For the base model (Columns 1 and 2), unlike the results obtained by using the Fama-MacBeth procedure reported in Table 3, the coefficient for dividend increases is positive and significant for the first year following the dividend event year, suggesting a positive association between dividend increases and earnings changes even without considering earnings volatility, contrary to Grullon et al. (2005). As before, the regression results, however, show no relation between dividend decreases and earnings changes.

Insert Table 4 about here

Columns 3 and 4 show the regression estimates of the modified model. Similar to the results obtained from the Fama-MacBeth procedure, we find a significantly positive relation between dividend increases and first-year earnings changes. The coefficient for dividend increases is 0.055. This relation is dependent on earnings volatility, which can be seen from the negative and significant coefficient for the interaction between dividend increases and earnings volatility. Again, these findings are consistent with Hypotheses 1a and 1b. For the second year following dividend increases, the direct relation between changes in dividends and changes in earnings disappears. The interaction, however, still plays some role in predicting future earnings. The relation between earnings volatility levels and future earnings changes is also present for both year 1 and year 2. No evidence of dividend signaling is found for dividend decreases.

4.2 Dividend increases and changes in future earnings for high earnings volatility

Tables 3 and 4 show that earnings volatility plays an important role in dividend signaling with higher volatility reducing the effectiveness of dividend increases in predicting higher future earn-

[14] Results for linear models are qualitatively similar.

ings. We further exam this phenomenon by constructing dummy variables for firms with high and low earnings volatility indicating when industry adjusted earnings volatility is in the top or bottom quartiles respectively. This allows us to distinguish whether the effect of volatility applies mainly to high or low volatility firms. Theory predicts that the mitigating effect of earnings volatility on the relation between dividend increases and higher future earnings should mainly apply to high volatility firms, since dividends could also signal lower future earnings volatility.

Table 5 reports the regression results of future earnings changes on dividend changes from the nonlinear models specifically for high and low volatility firms.[15] Columns 1 and 2 show the regression results in the presence of the high earnings volatility dummy; whereas Columns 3 and 4 show those in the presence of the low volatility dummy. We include both high and low volatility dummies in Columns 5 and 6. In all model specifications, the coefficients for dividend increases (DPC_0*R$\Delta$$Div_0$) are positive and significant for the first year but are insignificant for the second year. Furthermore, the results for the high volatility dummy are very similar to those we obtain using the continuous industry adjusted earnings volatility variable, and the conclusions are identical. For instance, we find a positive effect for dividend increases on first year future earnings changes, and a negative effect for the interaction between dividend increases and the high earnings volatility dummy. However, because we use a dummy variable, we can test the overall effect of dividend increases on future earnings changes for high volatility firms by summing the coefficients. In this case, the sum of the coefficients is -0.021, which is significantly negative as confirmed by an F test. Therefore, contrary to the traditional dividend signaling hypothesis, high volatility firms tend to experience a negative first year earnings change following

[15] The results with linear models are qualitatively similar, with identical conclusions.

a dividend increase.[16] We investigate how dividend changes affect earnings volatility in Section 4.3 in order to explain this puzzling observation.

Insert Table 5 about here

The results for the low earnings volatility dummy presented in Columns 3 and 4 tell a different story. We still find that the direct effect of dividend increases on earnings is positive; however, the interaction between dividend increases and the low earnings volatility dummy is not significant. This implies that dividend increases for low volatility firms do signal greater future earnings. The results from including both high and low volatility indicators yields identical conclusions to this already discussed: dividend increases signal earnings increases for low volatility firms, but not for high volatility firms.

4.3 Dividend increases and changes in future earnings volatility

In Table 6, we present the regression results of future industry adjusted earnings volatility changes on dividend changes for high and low volatility firms respectively. Columns 1-3 show the regression results for five-year changes in earnings volatility, and Column 4 shows the results for three-year changes. In general, dividend increases are negatively associated with future volatility changes as the coefficients for dividend increases are -0.354 and -0.328 for both high volatility and low volatility models. However, for high-volatility firms, the effect is much stronger, as suggested by the large negative coefficient (-0.562) for the interaction between dividend increases and the high volatility dummy, whereas the interaction between dividend increases and low volatility is not significant. The total effect of dividend increases on earnings volatility changes for high-volatility firms is the sum of the two coefficients, which is -0.916. It is significantly different from zero under an F test. This finding suggests that dividend increases signal lower future

[16] Similarly, high volatility firms experience a positive second year earnings change following a dividend decrease.

volatility in high-volatility firms.

Insert Table 6 about here

For low-volatility firms, the coefficient for the interaction between dividend increases and the low volatility dummy is positive, although not significant. We test the sum of coefficients for the interaction and dividend increases and find that the sum is not significantly different from zero, implying that dividend increases do not signal future earnings volatility reduction for low volatility firms. For dividend decreases, there seems to be a positive association between dividend changes and future earnings volatility changes. However, for low-volatility firms, this effect is eliminated by the negative coefficient for the interaction between dividend decreases and low volatility dummy. The coefficient is -1.349, resulting in a total effect of dividend decreases on earnings volatility changes of 0.355 – 1.349 = -0.994. This effect is significantly different from zero under an F test. In other words, in low-volatility firms, the larger the decrease in dividend, the larger the increase in earnings volatility. Furthermore, the signs of the coefficients for MB_{-1}, $SIZE_{-1}$, and LEV_{-1} are the same as previously expected. In sum, in high-volatility firms, dividend increases signal a reduction in earnings volatility rather than an increase in future earnings, which is consistent with our hypotheses. Interestingly, in low-volatility firms, dividend decreases mainly signal future increase in earnings volatility.

We also test a similar model in which both the high-volatility dummy and the low-volatility dummy enter simultaneously, shown in Columns 3 and 4 of Table 6. The results regarding dividend increases are consistent as those of the previous regression. We find a negative coefficient (-0.313) for dividend increases, which suggests a negative association between dividend increases and future volatility changes. This negative association is much stronger for high-volatility firms, as can be seen by the negative coefficient for the interaction between dividend increases and high volatility dummy that takes -0.607. The combined effect of dividend increases on earnings volatility changes for high-volatility firms is -0.92, which is significantly different from zero. For low volatility firms, there is no additional effect on volatility changes from dividend increases. For dividend decreases, we find a positive association between dividend changes and future earnings volatility changes. It also shows that in low-volatility firms the larger the decrease in dividend, the larger the earning volatility would increase.

For robustness, we further test three-year changes in earnings volatility as an alternative. Column 4 of Table 6 shows the regression results when both high-volatility dummy and low-volatility dummy are included. Even though the coefficient for dividend increases is not significant, the coefficient for the interaction between dividend increases and high-volatility is negative and significant. The combined coefficient of the two is also found to be negative and significant, suggesting that for high-volatility firms there is a negative association between dividend increases and future earnings volatility changes. This finding is consistent with that of the five-year changes. Moreover, the regression results also suggest that for low-volatility firms, larger dividend decreases lead to higher three-year future earnings volatility.

4.4 Robustness Tests

To evaluate the robustness of our results, we include a battery of various robustness tests.[17] We first repeat our analyses using alternative measures of earnings changes and dividend changes and/or include additional control variables, and test whether our results are subject to the above changes: 1) we redefine dividend changes by deflating quarterly dividend changes by stock prices instead of scaling by previous dividend payment; 2) we recalculate earnings changes as the difference in earnings divided by book value of assets rather than book value of common equi-

[17] We do not include tables of the robustness results; however results are available from the authors upon request.

ties; 3) in Equation (8), we control for firm age, defined as the natural logarithm of the number years since the firm appears on CRSP, as another variable to account for the uncertainty embedded in firm operations. We find that in all of these cases, our findings are similar those reported in our main tests.

5 Conclusion

The traditional dividend signaling theory suggests that dividend changes contain information about future profitability. However, prior research provides mixed results: the association between dividends and future profitability depends on how expected earnings are modelled. We show that regardless of whether a linear or nonlinear model for earnings expectations is used, there is a positive association between dividend increases and future profitability when earnings volatility is taken into consideration. However, this positive effect is mitigated by higher current earnings volatility. Specifically, we find that for firms with low earnings volatility, a dividend increase signals an increase in profitability. For firms with high earnings volatility, a dividend increase signals a reduction in future earnings volatility rather than an increase in future earnings. This explains why previous research fails to find consistent evidence for dividend signaling. However, consistent with previous literature, we do not find equivalent results for dividend decreases. Rather, dividend decreases are generally not related to earnings changes, although they are associated with increased future earnings volatility.

Our study has important implications for the corporate finance discipline. First, we validate the traditional dividend signaling theory that posits a positive association between dividend increases and future profitability. We show that this relation holds for both linear and non-linear models of earnings expectations. Second, we find that earnings volatility has a negative impact on the relation between dividend increases and future prospects. The signaling effect on future earnings is greater for low-volatility firms and diminishes for high-volatility firms. Third, we propose and find evidence that dividend changes signal changes in earnings volatility rather than earnings, such that for high-volatility firms, a dividend increase signals a reduction in earnings volatility. We provide strong evidence in support of dividend signaling and our findings shed new light on the information content of dividend changes.

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Table 1: Descriptive Statistics

This table presents summary statistics of major dependent and independent variables. The annual dividend change $R\Delta Div_\tau$ of a specific fiscal year τ is defined as the annualized rate of quarterly dividend changes. ΔE_τ is the annual change in earnings before extraordinary items in year τ deflated by the book value of equity in year -1. EV_0 is the industry-adjusted cash flow volatility. ΔEV_5 is the five year change in adjusted earnings volatility following the dividend event. All variables have been winsorized at 1st and 99th percentiles of the empirical distribution.

	Mean	SD	Min	25%	50%	75%	Max	N
				Panel A: Dividend Increases				
$R\Delta Div$	0.163	0.149	0.001	0.068	0.118	0.2	0.750	15,207
ΔE_1	0.010	0.081	-0.481	-0.011	0.015	0.040	0.420	14,493
ΔE_2	0.013	0.095	-0.549	-0.012	0.017	0.046	0.474	14,040
EV_0	0.848	0.698	0.093	0.415	0.639	1.028	7.195	8,648
ΔEV_5	0.128	0.721	-5.122	-0.156	0.047	0.311	5.638	5,555
				Panel B: Dividend Decreases				
$R\Delta Div$	-0.398	0.119	-0.5	-0.5	-0.444	-0.333	-0.001	1,307
ΔE_1	0.024	0.115	-0.481	-0.016	0.022	0.071	0.420	1,226
ΔE_2	0.015	0.125	-0.548	-0.021	0.019	0.062	0.474	1,174
EV_0	1.234	0.898	0.113	0.630	0.983	1.525	5.757	694
ΔEV_5	-0.120	0.911	-4.939	-0.427	-0.070	0.274	3.281	361
				Panel C: No Changes				
$R\Delta Div$	0	0	0	0	0	0	0	20,228
ΔE_1	0.007	0.111	-0.481	-0.024	0.014	0.047	0.420	18,736
ΔE_2	0.010	0.125	-0.548	-0.024	0.016	0.054	0.474	17,963
EV_0	1.062	0.815	0.116	0.548	0.830	1.310	8.460	10,488
ΔEV_5	0.088	0.901	-4.937	-0.284	0.012	0.376	7.028	5,320

Table 2: Dividend increases and changes in future earnings (Linear models)

This table presents results from regressing future earnings changes on dividend changes. E_τ is income before extraordinary items in year τ with year 0 as the event year. B_{-1} is the book value of equity at the end of year -1. $R\Delta Div_0$ is the annualized rate of quarterly dividend changes in year 0. DPC (DNC) is a dummy variable indicating dividend increases (decreases). EV_0 is the industry adjusted earnings volatility in year 0. $ROE_{\tau-1}$ is the earnings before extraordinary items in year τ-1 scaled by the book value of equity in year τ-1. Average R^2 is the average adjusted R^2 of the cross sectional-regressions. We use the Fama-MacBeth two-stage procedure to estimate the coefficients. We first run the annual cross-sectional regressions using observations only in that year; we then compute the mean coefficients and t-statistics. *, **, and *** represent statistical significance at 10%, 5%, and 1% respectively.

Dependent Variable = ΔE_τ				
	Base Model		Modified Model	
	$\tau = 1$	$\tau = 2$	$\tau = 1$	$\tau = 2$
Constant	0.018***	0.024***	0.019***	0.025***
	(3.27)	(5.34)	(3.20)	(5.25)
$DPC_0*R\Delta Div_0$	0.039***	0.041***	0.077***	0.070***
	(4.02)	(3.62)	(4.10)	(2.91)
DPC_0*EV_0			0.008***	0.013***
			(2.84)	(5.66)
$DPC_0*R\Delta Div_0*EV_0$			-0.052***	-0.069***
			(-2.81)	(-3.20)
$DNC_0*R\Delta Div_0$	-0.013	0.029*	0.011	0.005
	(-0.92)	(1.92)	(0.38)	(0.19)
DNC_0*EV_0			0.025	0.062**
			(1.09)	(2.77)
$DNC_0*R\Delta Div_0*EV_0$			0.050	0.156***
			(0.84)	(2.92)
$ROE_{\tau-1}$	-0.131***	-0.172***	-0.151***	-0.191***
	(-5.26)	(-8.72)	(-5.42)	(-9.53)
ΔE_0	-0.095**	0.118	-0.078*	-0.023
	(-2.55)	(-0.94)	(-1.82)	(-0.94)
Average R^2	0.063	0.054	0.084	0.069

Table 3: Dividend increases and changes in future earnings (Nonlinear models)

This table presents results from regressing future earnings changes on dividend changes. E_τ is income before extraordinary items in year τ with year 0 as the event year. B_{-1} is the book value of equity at the end of year -1. $R\Delta Div_0$ is the annualized rate of quarterly dividend changes in year 0. DPC (DNC) is a dummy variable indicating dividend increases (decreases). EV_0 is the industry adjusted earnings volatility in year 0. DFE_0 equals ROE_0 – $E[ROE_0]$, where ROE_0 is the ratio of income before extraordinary items to total common equity in year 0 and $E[ROE_0]$ is the fitted value form the cross-sectional regressions of ROE_0 on the logarithm of total assets in year -1, the logarithm of the market-to-book ratio of equity in year -1, and ROE_{-1}. $NDFED_0$ ($PDFED_0$) is a dummy variable indicating that DFE_0 is negative (positive). CE_0 equals $(E_0 - E_{-1})/B_{-1}$. $NCED_0$ ($PCED_0$) is a dummy variable indicating that CE_0 is negative (positive). Average R^2 is the average adjusted R^2 of the cross sectional-regressions. We use the Fama-MacBeth two-stage procedure to estimate the coefficients. *, **, and *** represent statistical significance at 10%, 5%, and 1% respectively.

Dependent Variable = ΔE_τ				
	Base Model		Modified Model	
	$\tau = 1$	$\tau = 2$	$\tau = 1$	$\tau = 2$
Constant	-0.008***	0.008**	-0.009***	0.0076*
	(-2.78)	(2.38)	(-2.95)	(1.97)
$DPC_0*R\Delta Div_0$	0.010	0.009	0.068***	0.006
	(0.98)	(0.94)	(3.41)	(0.31)
DPC_0*EV_0			0.005*	0.007***
			(1.74)	(3.02)
$DPC_0*R\Delta Div_0*EV_0$			-0.053**	-0.032
			(-2.77)	(-1.54)
$DNC_0*R\Delta Div_0$	-0.004	0.019	-0.0068	-0.0026
	(-0.25)	(1.28)	(-0.30)	(-0.09)
DNC_0*EV_0			0.021	0.042*
			(0.96)	(2.00)
$DNC_0*R\Delta Div_0*EV_0$			0.055	0.112**
			(1.14)	(2.16)
DFE_0	-0.113	-0.146*	-0.126	-0.181**
	(-1.51)	(-1.84)	(-1.70)	(-2.14)
$NDFED_0*DFE_0$	-0.364***	-0.019	-0.410***	-0.022
	(-2.90)	(-0.15)	(-2.98)	(-0.16)
$NDFED_0*DFE_0^2$	0.007	-0.127	-0.026	-0.405
	(0.03)	(-0.54)	(-0.11)	(-1.23)
$PDFED_0*DFE_0^2$	0.063	0.378	0.259	0.420
	(0.16)	(0.99)	(0.65)	(1.05)
CE_0	0.276***	0.079	0.287***	0.120
	(3.96)	(1.00)	(4.79)	(1.67)
$NCED_0*CE_0$	-0.124	0.011	-0.098	0.012
	(-1.06)	(0.08)	(-0.81)	(0.08)
$NCED_0*CE_0^2$	0.450	0.200	0.720**	0.642
	(1.36)	(0.59)	(2.10)	(1.27)
$PCED_0*CE_0^2$	-0.829***	-0.517*	-0.959***	-0.596**
	(-3.78)	(-1.96)	(-4.51)	(-2.47)
Average R^2	0.116	0.033	0.143	0.043

Table 4: Dividend increases and changes in future earnings (Nonlinear models, Rogers standard errors)

This table presents results from regressing future earnings changes on dividend changes. E_τ is income before extraordinary items in year τ with year 0 as the event year. B_{-1} is the book value of equity at the end of year -1. $R\Delta Div_0$ is the annualized rate of quarterly dividend changes in year 0. DPC (DNC) is a dummy variable indicating dividend increases (decreases). EV_0 is the industry adjusted earnings volatility in year 0. DFE_0 equals ROE_0 – $E[ROE_0]$, where ROE_0 is the ratio of income before extraordinary items to total common equity in year 0 and $E[ROE_0]$ is the fitted value form the cross-sectional regressions of ROE_0 on the logarithm of total assets in year -1, the logarithm of the market-to-book ratio of equity in year -1, and ROE_{-1}. $NDFED_0$ ($PDFED_0$) is a dummy variable indicating that DFE_0 is negative (positive). CE_0 equals $(E_0 - E_{-1})/B_{-1}$. $NCED_0$ ($PCED_0$) is a dummy variable indicating that CE_0 is negative (positive). *, **, and *** represent statistical significance at 10%, 5%, and 1% respectively.

	Dependent Variable = ΔE_τ			
	Base Model		Modified Model	
	$\tau = 1$	$\tau = 2$	$\tau = 1$	$\tau = 2$
Constant	0.002	-0.002	-0.002	-0.002
	(0.48)	(-0.39)	(-0.32)	(-0.35)
$DPC_0 * R\Delta Div_0$	0.019***	0.006	0.055***	0.009
	(2.97)	(0.89)	(4.55)	(0.6)
$DPC_0 * EV_0$			0.005***	0.007***
			(2.8)	(3.36)
$DPC_0 * R\Delta Div_0 * EV_0$			-0.045***	-0.037**
			(-3.87)	(-2.38)
$DNC_0 * R\Delta Div_0$	-0.007	0.010	0.009	0.010
	(-0.69)	(0.81)	(0.44)	(0.39)
$DNC_0 * EV_0$			-0.012	0.021*
			(-0.6)	(1.66)
$DNC_0 * R\Delta Div_0 * EV_0$			-0.043	0.049
			(-0.96)	(1.43)
DFE_0	-0.109*	-0.142**	-0.099	-0.168**
	(-1.77)	(-2.09)	(-1.46)	(-2.21)
$NDFED_0 * DFE_0$	-0.410***	-0.035	-0.452***	-0.026
	(-3.81)	(-0.31)	(-3.63)	(-0.19)
$NDFED_0 * DFE_0^2$	-0.378*	-0.116	-0.318	-0.211
	(-1.76)	(-0.57)	(-1.29)	(-0.89)
$PDFED_0 * DFE_0^2$	0.152	0.157	0.277	0.172
	(0.56)	(0.58)	(0.96)	(0.57)
CE_0	0.332***	0.053	0.309***	0.085
	(6.58)	(0.92)	(5.62)	(1.25)
$NCED_0 * CE_0$	-0.109	0.070	-0.133	0.026
	(-1.24)	(0.69)	(-1.27)	(0.21)
$NCED_0 * CE_0^2$	1.014***	0.166	0.821***	0.230
	(3.74)	(0.57)	(2.67)	(0.74)
$PCED_0 * CE_0^2$	-0.977***	-0.216	-1.001***	-0.306
	(-5.05)	(-1.07)	(-4.94)	(-1.29)
Year fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.089	0.031	0.105	0.034
Firm-year observations	26,885	25,698	18,969	18,204

Table 5: Dividend increases and changes in future earnings for high/low earnings volatility (Nonlinear models)

This table presents results from regressing future earnings changes on dividend changes. $DHEV_0$ is a dummy variable indicating that EV_0 is larger than 75% of all EV_0. $DLEV_0$ is a dummy variable indicating that EV_0 is smaller than 25% of all EV_0. ΔE_τ is the annual change in earnings before extraordinary items in year τ relative to the dividend event year (year 0) deflated by the book value of equity in year -1. $R\Delta Div_0$ is the annualized rate of quarterly dividend changes in year 0. DPC (DNC) is a dummy variable indicating dividend increases (decreases). DFE_0 is equal to $ROE_0 – E[ROE_0]$, where ROE_0 is the ratio of income before extraordinary items to total common equity in year 0 and $E[ROE_0]$ is the fitted value form the cross-sectional regressions of ROE_0 on the logarithm of total assets in year -1, the logarithm of the market-to-book ratio of equity in year -1, and ROE_{-1}. $NDFED_0$ ($PDFED_0$) is a dummy variable indicating that DFE_0 is negative (positive). CE_0 equals $(E_0 - E_{-1})/B_{-1}$. $NCED_0$ ($PCED_0$) is a dummy variable indicating that CE_0 is negative (positive). *, **, and *** represent statistical significance at 10%, 5%, and 1% respectively.

	Dependent Variable = ΔE_τ					
	τ = 1	τ = 2	τ = 1	τ = 2	τ = 1	τ = 2
Constant	-0.0003	-0.001	-0.001	-0.0005	-0.002	-0.001
	(-0.06)	(-0.09)	(-0.21)	(-0.09)	(-0.37)	(-0.23)
$DPC_0*R\Delta Div_0$	0.031***	-0.007	0.016*	-0.017	0.027***	-0.013
	(3.67)	(-0.61)	(1.74)	(-1.48)	(2.77)	(-1.02)
DPC_0*DHEV_0	0.008**	0.009**			0.009**	0.010**
	(1.98)	(2.20)			(2.22)	(2.31)
DPC_0*DLEV_0			0.009***	0.004*	0.010***	0.005*
			(3.87)	(1.68)	(4.11)	(1.96)
$DPC_0*R\Delta Div_0*DHEV_0$	-0.052**	-0.039			-0.049**	-0.032
	(-2.32)	(-1.50)			(-2.09)	(-1.18)
$DPC_0*R\Delta Div_0*DLEV_0$			-0.011	0.009	-0.022	0.004
			(-0.59)	(0.40)	(-1.12)	(0.19)
$DNC_0*R\Delta Div_0$	-0.010	-0.004	-0.006	0.020	-0.006	0.002
	(-0.92)	(-0.23)	(-0.52)	(1.29)	(-0.54)	(0.1)
DNC_0*DHEV_0	-0.012	0.062**			-0.011	0.062**
	(-0.33)	(2.29)			(-0.31)	(2.29)
DNC_0*DLEV_0			0.015	-0.047	0.016	-0.046
			(0.70)	(-1.50)	(0.74)	(-1.47)
$DNC_0*R\Delta Div_0*DHEV_0$	-0.024	0.181**			-0.027	0.177**
	(-0.29)	(2.53)			(-0.33)	(2.45)
$DNC_0*R\Delta Div_0*DLEV_0$			0.011	-0.165**	0.012	-0.146*
			(0.16)	(-1.97)	(0.17)	(-1.74)
DFE_0	-0.102	-0.168**	-0.097	-0.158**	-0.098	-0.164**
	(-1.50)	(-2.21)	(-1.42)	(-2.06)	(-1.44)	(-2.15)
$NDFED_0*DFE_0$	-0.451***	-0.026	-0.456***	-0.029	-0.458***	-0.031
	(-3.62)	(-0.19)	(-3.65)	(-0.21)	(-3.67)	(-0.23)
$NDFED_0*DFE_0^2$	-0.323	-0.212	-0.323	-0.205	-0.326	-0.212
	(-1.31)	(-0.90)	(-1.31)	(-0.87)	(-1.33)	(-0.9)
$PDFED_0*DFE_0^2$	0.274	0.166	0.263	0.143	0.270	0.159
	(0.94)	(0.55)	(0.90)	(0.47)	(0.93)	(0.52)
CE_0	0.305***	0.079	0.316***	0.084	0.317***	0.086
	(5.56)	(1.16)	(5.76)	(1.24)	(5.76)	(1.27)

$NCED_0*CE_0$	-0.113	0.046	-0.140	0.021	-0.144	0.024
	(-1.07)	(0.38)	(-1.34)	(0.18)	(-1.37)	(0.2)
$NCED_0*CE_0^2$	0.870***	0.272	0.833***	0.232	0.822***	0.238
	(2.83)	(0.88)	(2.71)	(0.74)	(2.67)	(0.76)
$PCED_0*CE_0^2$	-0.997***	-0.296	-1.026***	-0.315	-1.021***	-0.312
	(-4.95)	(-1.26)	(-5.08)	(-1.33)	(-5.06)	(-1.32)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.104	0.033	0.104	0.033	0.105	0.034
Firm-year observations	18,969	18,204	18,969	18,204	18,969	18,204

Table 6: Dividend increases and changes in future earnings volatility

This table presents results from regressing future earnings volatility changes on dividend changes. $DHEV_0$ is a dummy variable indicating that EV_0 is in the top quartile. $DLEV_0$ is a dummy variable indicating that EV_0 is in the bottom quartile. EV_0 is the industry adjusted earnings volatility in year 0. ΔEV_5 is the five year change in adjusted earnings volatility following the dividend event. $R\Delta Div_0$ is the annualized rate of quarterly dividend changes in year 0. DPC (DNC) is a dummy variable indicating dividend increases (decreases) and 0 otherwise. MB_{-1} is the natural logarithm of the market-to-book ratio in year -1. $SIZE_{-1}$ is the natural logarithm of the book value of total assets in year -1. LEV_{-1} is the ratio of total long term debt to book value of total assets. *, ** and *** represent statistical significance at 10%, 5% and 1% levels.

Dependent Variable = ΔEV_τ				
	ΔEV_5			ΔEV_3
Constant	0.854***	0.882***	0.892***	0.376***
	(7.85)	(8.23)	(8.10)	(6.32)
DPC_0*$R\Delta Div_0$	-0.354***	-0.328***	-0.313***	-0.092
	(-3.85)	(-3.81)	(-3.28)	(-1.21)
DPC_0*$DHEV_0$	0.230***		0.235***	0.084*
	(3.22)		(3.25)	(1.82)
DPC_0*$DLEV_0$		-0.122***	-0.123***	-0.064**
		(-2.85)	(-2.77)	(-2.23)
DPC_0*$R\Delta Div_0$*$DHEV_0$	-0.562**		-0.607**	-0.450**
	(-2.14)		(-2.27)	(-2.40)
DPC_0*$R\Delta Div_0$*$DLEV_0$		0.283	0.267	0.040
		(1.46)	(1.34)	(0.30)
DNC_0*$R\Delta Div_0$	0.138	0.355***	0.216**	-0.014
	(1.59)	(3.26)	(2.31)	(-0.16)
DNC_0*$DHEV_0$	-0.386		-0.382	-0.488***
	(-1.55)		(-1.54)	(-2.77)
DNC_0*$DLEV_0$		-0.419**	-0.423**	-0.275*
		(-2.12)	(-2.15)	(-1.67)
DNC_0*$R\Delta Div_0$*$DHEV_0$	-0.563		-0.650	-1.295***
	(-0.90)		(-1.04)	(-2.88)
DNC_0*$R\Delta Div_0$*$DLEV_0$		-1.349**	-1.217**	-0.686
		(-2.37)	(-2.15)	(-1.51)
$ROE_{\tau-1}$	-0.583***	-0.572***	-0.601***	-0.333***
	(-12.65)	(-12.73)	(-11.77)	(-11.24)
ΔE_0	0.053**	0.059**	0.055**	0.012
	(2.28)	(2.56)	(-1.96)	(0.72)
Year fixed effects	-0.016**	-0.013	-0.015***	-0.008*
Firm fixed effects	(-2.15)	(-1.78*)	(-1.96)	(-1.71)
Average R^2	-0.258***	-0.236**	-0.257***	-0.165**
Firm-year observations	(-2.66)	(-2.44)	(-2.66)	(-2.53)

Appendix: Definitions of Variables

ΔE_τ	The annual change in earnings before extraordinary items in year τ relative to the dividend event year (year 0) deflated by the book value of equity in year -1.
$R\Delta Div_0$	The annual dividend change in a fiscal year, calculated as the annualized rate of quarterly dividend changes $\Delta Div_{t,q}$.
DPC (DNC)	A dummy variable that takes the value one for dividend increases (decrease) and zero otherwise.
EV_τ	The industry-adjusted earnings volatility in year τ relative to the dividend event year (year 0), measured as the standard deviation of quarterly earnings before extraordinary items on the book value of total assets over a five-year rolling period, divided by its industry average based on 2-digit SIC code.
ΔEV_5	The five year change in industry-adjusted earnings volatility following the dividend event, calculated as EV_5 - EV_0.
$DHEV_0$ ($DLEV_0$)	A dummy variable that takes the value one if a firm's current volatility level belongs to the top (bottom) 25% of the entire sample volatilities and zero otherwise.
DFE_0	ROE_0 – $E[ROE_0]$, where $E[ROE_0]$is calculated as the fitted value from the annual cross-sectional regressions of ROE_0 on the natural logarithm of the book value of total assets in year -1, the nature logarithm of the market to book ratio in year -1, and the return on equity in year -1 relative to the dividend event year.
$NDFED_0$ ($PDFED_0$)	A dummy variable that takes the value one if DFE_0 is negative (positive) and zero otherwise.
CE_0	The earnings change in the dividend event year deflated by the book value of common equity in year -1
$NCED_0$ ($PCED_0$)	A dummy variable that takes the value one if CE_0 is negative (positive) and zero otherwise.
ROE_τ	Return-on-equity, measured as the earnings before extraordinary items in year τ deflated by the book value of equity in year τ.
ROA_τ	Return-on-asset, defined either as the ratio of operating income before depreciation to the book value of total assets in year τ, or the ratio of income before extraordinary items to the book value of total assets in year τ.
MB_{-1}	Market-to-book ratio, measured as the natural logarithm of the market-to-book ratio in year -1.