Dividend Changes and the Revision of Earnings Persistence Conditional on Investors' Prior Information

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Abstract

When investors observe an earnings surprise they must assess its persistence in order to price it. The resulting assessment of persistence can be influenced further by management, through sending dividend signals. As Koch and Sun (2004) show, a dividend change in the same direction as the preceding earnings surprise is interpreted as a supporting signal for the persistence of the earnings surprise. We analyze how this corroborating effect of a dividend signal depends on a-priori investor knowledge about earnings persistence, which is proxied by previous time-series persistence. At first glance, one might assume that the value of a corroborating dividend signal is high (low) if the a-priori assessment of earnings persistence is low (high). However, a simple Bayesian model demonstrates that the benefit of the dividend signal depends on both the prior assessment of earnings persistence and the reliability of dividend information. Because dividend changes cannot perfectly reveal earnings persistence, the dividend signal's benefit does not depend monotonically on the a-priori assessment in general. Instead, we find that the relationship is inverse u-shaped. Our empirical results strongly confirm the inverse u-shaped relation for the case of confirming signals, while our empirical results for the case of contradicting signals are mixed.

Keywords: Information Releases, Dividends, Earnings, Earnings Persistence

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1. Introduction

Accounting numbers provide firm-specific information about future profitability. The aggregate measure of accounting earnings is an important example. As shown by Ball and Brown (1968) or Beaver (1968), earnings contain value-relevant information and investors react to such announcements. Further evidence shows that the impact of the earnings number on prices depends on the degree to which the new information affects future periods. That is, an earnings announcement revealing new information becomes even more important, the more it persists into the future.[1] However, the earnings number itself is not a perfect indicator, so that investor expectations about the persistence of earnings are only vague. Freeman and Tse (1989) show that investors use additional, post-announcement information in order to update their knowledge and to reassess the value implications of the earnings announcement. Management's dividend decision is an important way to communicate additional information about future prospects to the market. Koch and Sun (2004) find that post-announcement dividend changes help investors to revise their a-priori expectations about the earnings persistence of a current earnings change. Specifically, market participants interpret a dividend change which follows a preceding earnings change of the same sign, as a confirming signal about the persistence of the preceding earnings change. However, the benefit of the supporting dividend signal will depend on the information investors already have when they observe the unexpected earnings change. In order to analyze this issue, we extend Koch and Sun's (2004) model by considering a-priori investor assessment of earnings persistence.

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[1] Beaver et al. (1980), Easton and Zmijewski (1989), Kormendi and Lipe (1987), and Penman (1992) find that the market reaction is positively related to the persistence of earnings.

When market participants observe an earning change, they cannot fully anticipate its persistence. However, the earnings themselves provide investors with persistence-related information. Under the concept of earnings quality, prior research subsumes several desirable earnings attributes which comprise relevant, firm-specific properties. Among these measures, some can be identified which explicitly try to capture the persistence of earnings or which are at least positively correlated with earnings persistence.[2] In our empirical tests, we rely on the first group of measures, past earnings time-series persistence. We focus exclusively on this measure, as we generally do not know how values of an earnings quality metric are transformed into a-priori investor assessments of earnings persistence. Additionally, in order to empirically support the predictions derived from our model, a solid relationship between investor assessment of persistence and the proxy for earnings persistence is needed. This requirement would best be met if an earnings quality metric measures earnings persistence directly. Firms which differ with respect to estimated, past time-series persistence should yield systematic differences in a-priori investor assessments of earnings persistence. Thus, firms which have exhibited overall sustainable earnings in past should be assigned a relatively high a-priori assessment of persistence, in comparison to firms whose earnings streams have been rather transitory. We focus on how the benefits of dividend signals change, when taking into account this firm-specific time-series information about persistence.

At first glance, one might assume that investor revisions should be stronger for firms with relatively low past earnings persistence. Similarly, Mikhail et al. (2003) find a statistically significant negative association between the market reaction to dividend increases and earnings quality. They argue that the relevance of new information (dividend changes) relies on the

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[2] An analysis of earnings quality metrics which are commonly used in literature is provided by Dechow et al. (2010), who also report the correlations between the different measures.

quality of previously released information (earnings). Basically, both earnings and dividends are seen as substitute sources of information. The new information then becomes more important, the poorer the quality of the old information. Analogously, one might be tempted to infer that the confirming dividend signal should have a stronger effect on firms whose past earnings persistence is low. However, using a simple Bayesian model, we show that the relationship is not that trivial. In particular, we observe that investor revisions of earnings persistence are generally not monotonic with respect to past earnings persistence. Instead, the relationship reveals an inverse u-shape. The reason is that the dividend signal itself is not a perfect indicator of earnings persistence. This inherent uncertainty of the confirming dividend change, lowers the signalling effect in general and in particular, reduces the benefit of the signal for firms with low past earnings persistence. If, a-priori, investors believe in low earnings persistence, they will not be willing to deviate much from this preassessment when observing a confirming dividend signal. In such cases, they only alter their expectations conservatively upwards. If the inherent risk of the dividend signal is eliminated, the dividend signal becomes a perfect indicator of earnings persistence. Only in this theoretical corner case, does the intuitively presumed monotonic relationship emerge.

Our deliberations can also be extended to contradictory dividend changes. Koch and Sun (2004) further demonstrate that a dividend increase (decrease), which follows a preceding earnings decrease (increase), is interpreted by investors as a contradictory signal of earnings persistence. The dividend signal does not then corroborate a-priori investor assessment; instead the pre-assessment is revised in the reverse direction. In this case, our model generally implies a non-monotonic, u-shaped relationship which again leads to the strongest (negative) revision, if investors believe a-priori in moderate earnings persistence. Analogously to the case of confirming dividend changes, the u-shaped relationship converges to a monotonic, linearly decreasing relationship, if the noise within the dividend signal tends towards zero.

Our theoretical results are consistent with Holthausen and Verrecchia (1988), who examine the relationship between two information signals in a multi-asset and multi-period, partial equilibrium model. Specifically, they analyze how the importance of the second information signal changes, when varying the quality of the first or the second information signal. Although their analysis rests on different assumptions, such as assuming normally distributed assets and signals, their results are generally compatible with the inferences in our specific model.

We contribute to the literature in two respects. Firstly, we show that the benefit of a subsequent information signal does not necessarily depend monotonically on the quality of the preceding information signal. Contrary to our results, many empirical studies hypothesize that the relevance of a disclosure should be negatively related to the quality of predisclosure information.[3] Secondly, we further clarify the role of dividends in signalling future firm performance. This relationship is theoretically motivated by Bhattacharya (1979), John and Williams (1985) and Miller and Rock (1985). In their dividend signalling models, managers possess private information about future firm performance which is conveyed to the market through their dividend decision. Healy and Palepu (1988) provide empirical evidence supporting this hypothesis, by showing that future earnings increases – a proxy for future, positive firm performance – follow preceding dividend initiations and, correspondingly, future earnings decreases are pre-empted by dividend omissions. Benartzi et al. (1997) analyze whether the same relationship prevails when considering the more frequent case of dividend changes. Their results

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[3] See, for instance, Mikhail et al. (2003) who find that dividend increases are negatively correlated to earnings quality, where earnings quality is defined as the ability of earnings to predict future operating cash flows. Also, Francis et al. (2002) hypothesize that the usefulness of a subsequent earnings announcement should be negatively related to the quality or informativeness of predisclosure information (analyst reports). However, their empirical results suggest a monotonic, positive association.

indicate a more subtle relationship, when considering weaker dividend signals. Specifically, they demonstrate that a current increase in earnings is more persistent for firms that increase their dividends, providing the basis for Koch and Sun's (2004) findings that investors interpret a dividend change de facto as an updating signal of earnings persistence. Similarly, in a recent study, Skinner and Soltes (2010) reveal a link between dividends and earnings persistence. They find that firms which pay dividends generally have more sustainable earnings than non-dividend payers. Our paper pursues this line of research and makes the following contributions. Our theoretical results show that an imperfect dividend signal, supporting the persistence of a preceding earnings surprise, is most valuable when investors believe a-priori in moderate persistence. This initially counterintuitive result is due to the uncertainty of the dividend signal itself. This finding should be important for both investors and managers. For investors whose a-priori assessments are relatively low, a supporting dividend signal has a merely incremental benefit for assessing earnings persistence. Instead, investors should value a confirming dividend change highest if they believe a-priori in a moderate level of persistence. The result should also be useful to managers considering announcing a dividend payment. In order to confirm the persistence of a preceding earnings change, they should be aware of the fact that the costly dividend signal is most useful if investors already believe in moderate earnings persistence. However, investors and management should note that this general result may change, if management sends extremely strong dividend signals. In such cases, the dividend signal tends towards a perfectly revealing information signal, rendering the a-priori information increasingly obsolete. If the confirming dividend change is sufficiently large, the inverse u-shape may turn into a monotonically decreasing relationship, leading to the strongest possible revision for a-priori assessed low-persistence firms.

In the case of confirming dividend changes, we obtain strong empirical support for our theoretical deliberations which generally predict an inverse u-shaped relationship. We also can find that this relationship tends towards a monotonically decreasing relationship, if the reliability of the dividend signal is enhanced. In the case of contradictory dividend changes, we generally find a non-monotonic u-shaped relationship. However, when enhancing the reliability of the contradicting dividend signal, the results are mixed, as the u-shaped relationship does not move steadily towards a monotonically decreasing relationship.

The remainder of the paper is organized as follows. Section 2 presents a Bayesian model of the interrelationship between the confirming dividend signal and the a-priori investor knowledge about earnings persistence. In Section 3, we present our sample criteria, variable measurement and the descriptive statistics of the variables. Section 4 presents the research design, Section 5 the empirical results and Section 6 concludes.

2. The Model

We begin with a short description of Koch and Sun's (2004) model in order to analyze confirming dividend signals. The model focuses on two points in time, one at which the quarterly dividend change ΔD is announced, t, and the time point before, $t\text{-}\varepsilon$, at which the preceding earnings change ΔE is disclosed. At $t\text{-}\varepsilon$, investors form expectations about the persistence of the observed, unexpected earnings change. They believe, with probability p_{prior}, that this change is sustainable. This assessment will evoke a price change R_E, as investors raise their performance expectations of the firm upwards, in the case of a positive unexpected earnings change and downwards in the case of a negative unexpected earnings change. If this earnings change is followed by a dividend change of the *same sign* as the preceding quarterly unexpected earnings change, investors will interpret this dividend information as a signal *confirming* the persistence of the preceding earnings change. Specifically, investors alter their a-priori assessment from p_{prior} to p_{post} (with $p_{post} > p_{prior}$), as they believe more strongly in the sustainability of the unexpected earnings change. This reassessment of persistence, the difference $\Delta p := p_{post} - p_{prior}$, causes another price reaction centered around the dividend change. In the case of a positive (negative) earnings/dividend change, investors believe in even better (worse) value contributions in future periods, leading to a positive (negative) price change R_D around the dividend change. The described effects are summarized in Figure 1.

[Figure 1]

These considerations can be formalized according to Koch and Sun's model of lagged earnings response coefficients, ERCs. In t-ε, investors face the unexpected earnings change ΔE. The evolved price reaction R_E is connected to the triggering earnings change ΔE, via the earnings response coefficient (ERC). The ERC describes how much a security's price changes as a result of a one dollar unexpected change in earnings. It is assumed that investors consider only two possible cases: (1) the earnings change is persistent or (2) it is transitory. In the first case, investors will react more strongly to a one dollar unexpected change in earnings than in the second case. Hence, the ERC for a persistent unexpected earnings change (ERC_{pers}) is higher than the ERC which captures the effects of a transitory unexpected earnings change (ERC_{trans}):

$$ERC_{pers} > ERC_{trans} \tag{1}$$

When observing the unexpected earnings change, investors believe a-priori with a probability p_{prior} in a persistent earnings change and correspondingly with a probability 1-p_{prior} in a transitory earnings change. It is assumed that the overall investor price reaction R_E in t-ε conforms to the expected change in the described scenario:

$$R_E = \left[p_{prior} \cdot ERC_{pers} + \left(1 - p_{prior}\right) \cdot ERC_{trans} \right] \cdot \Delta E \tag{2}$$

In the next step, the price reaction R_D associated with the subsequent, confirming dividend change ΔD is analyzed, which is driven by the positive revision Δp:

$$\begin{aligned} R_D &= \left[p_{post} \cdot ERC_{pers} + \left(1 - p_{post}\right) \cdot ERC_{trans} \right] \cdot \Delta E - \left[p_{prior} \cdot ERC_{pers} + \left(1 - p_{prior}\right) \cdot ERC_{trans} \right] \cdot \Delta E \\ &= \left(p_{post} - p_{prior} \right) \cdot \left(ERC_{pers} - ERC_{trans} \right) \cdot \Delta E \\ &= \Delta p \cdot \left(ERC_{pers} - ERC_{trans} \right) \cdot \Delta E = \beta \cdot \Delta E \end{aligned} \tag{3}$$

with $\beta > 0$

Equation (3) reveals a positive relationship between the price reaction R_D at the dividend change and the preceding earnings change ΔE. The reassessment of probabilities Δp, together with the difference between ERC_{pers} and ERC_{trans} create a positive factor β, which can be interpreted as a "differential" ERC. This factor updates the a-priori ERC in (2) to an a-posteriori ERC, which comprises both the consequences of the earnings and of the confirming dividend announcement.

In the following analysis which extends that of Koch and Sun (2004), we examine how the (unconditional) reassessment of earnings persistence – induced by the dividend signal – depends on a-priori investor knowledge about earnings persistence. Specifically, we model the delta between the a-posteriori and the a-priori probability Δp as a function of a-priori investor assessment p_{prior}. In t-ε, investors observe the unexpected earnings change ΔE. With respect to the future development, it is again assumed that only two cases are possible: (1) the earnings change will persist or (2) the earnings change is transitory. Investors believe with probability p_{prior} that the observed unexpected earnings change is persistent and with 1- p_{prior} that it is transitory. These effects are illustrated in the left part of Figure 2.

[Figure 2]

In the second part of Figure 2, a situation is captured in which managers either confirm or contradict the preceding earnings change ΔE with their dividend decision ΔD. In both cases – a persistent or a transitory earnings change – they can send a confirming or non-confirming signal. Again, a confirming dividend change occurs, if the dividend change and the preceding earnings change have the same sign. We refer to a firm's dividend decision as non-confirmative if the firm does not change its dividend payment or if the dividend change contradicts the preceding earnings change. In the latter case, the dividend change and the preceding earnings change have opposing signs. We assume that management intends to send a confirming dividend signal if and only if it believes that the earnings change is persistent. For instance, a preceding earnings increase is confirmed by a corresponding dividend increase, only if management believes in a persistent earnings change. In the case of a transitory earnings change, it will not increase dividend payments, in order to prevent a possible reversal of its decision in the future. This assumption is in accordance with Lintner's (1956) argument that managers avoid increasing dividends, unless they feel confident that they can maintain the higher dividend level in the future. The same intuition is valid for a previous earnings decrease. According to Lintner (1956), management is generally extremely reluctant to cut dividends, and hence decides to reduce dividends in our model, if and only if the firm suffers a permanent earnings decline. Consequently, we should observe a confirming dividend signal exclusively in the case of a persistent earnings change. However, though being insiders of the firm, management might misjudge the state of the earnings change. That is, we do not generally claim that managers can perfectly discern the true state of the earnings change. Hence, management may erroneously send a confirming dividend signal even in the case of a transitory earnings change. However, we still assume that the dividend decision is a credible signal of earnings persistence, so that we expect management to support a persistent earnings change more than a transitory one:

$$a := \mathrm{P}\left(confirmative \middle| \Delta E_{pers}\right) > \mathrm{P}\left(confirmative \middle| \Delta E_{trans}\right) =: b \quad \text{with } b \geq 0 \tag{4}$$

Furthermore, we assume that these probabilities are known to investors, which enables us – by applying Bayes' Rule – to determine a-posteriori investor assessment p_{post}:

$$p_{post} = \frac{p_{prior} \cdot a}{p_{prior} \cdot a + \left(1 - p_{prior}\right) \cdot b} \tag{5}$$

In addition, we obtain an expression for the anchor which drives the price reaction to the dividend change, the delta between a-posteriori and a-priori:[4]

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[4] See equation (3).

$$\Delta p = \Delta p\left(p_{prior}\right) = \frac{p_{prior} \cdot a}{p_{prior} \cdot a + \left(1 - p_{prior}\right) \cdot b} - p_{prior} \qquad (6)$$

This function represents the importance of a confirming dividend signal that is conditional on a-priori investor assessment of earnings persistence p_{prior}. We next show that this relationship is generally not monotonic; instead, Δp is an inverse u-shaped function of p_{prior}. Obviously, Δp does not increase or decrease monotonically in p_{prior}, as the following properties hold:

a) $\Delta p\left(0\right) = 0$ (7)

b) $\Delta p\left(1\right) = 0$ (8)

c) $\Delta p\left(p_{prior}\right) > 0 \quad \text{for } 0 < p_{prior} < 1$ (9)

Furthermore we obtain:

d) $$\frac{\partial \Delta p}{\partial p_{prior}} = \frac{ab}{\left(p_{prior} \cdot a + \left(1 - p_{prior}\right) \cdot b\right)^2} - 1 \qquad (10)$$

e) $$\frac{\partial^2 \Delta p}{\partial p_{prior}^2} = -\frac{2ab\left(a - b\right)}{\left(p_{prior} \cdot a + \left(1 - p_{prior}\right) \cdot b\right)^3} < 0 \qquad (11)$$

The second derivative of the function is strictly negative for all p_{prior}, which implies a concave function. Strict concavity, together with equation (10) constitutes a maximum point at:

$$p_{prior}^{max} = \frac{\sqrt{ab} - b}{a - b} < 0.5 \tag{12}$$

Inserting into equation (6) yields the maximum value:

$$\Delta p\left(p_{prior}^{max}\right) = \frac{\left(\sqrt{a} - \sqrt{b}\right)^2}{a - b} \tag{13}$$

So far, we have shown that the relationship between the a-posteriori and a-priori assessment has an inverse u-shape, with the maximum point (12) and maximum value (13). (12) also shows that the function is asymmetric, as the maximum point is strictly lower than 0.5. Both the maximum point and maximum value depend on the conditional probabilities, *a* and *b*, that a firm sends a confirmative signal, either when facing a persistent or a transitory earnings change. Below, we examine this relationship in more detail.

The two parameters, *a* and *b*, determine the reliability and hence the importance of the dividend signal. The confirming dividend signal achieves its maximum benefit, if it signals earnings persistence perfectly. This is the case if $a > 0$ and $b = 0$. Then, only persistent earnings changes would be supported by a confirming dividend change ($a > 0$), while a transitory change would certainly be followed by a non-confirming signal ($b = 0$).[5] As a result, each a-priori assessment

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[5] See Figure 2.

would be updated to the maximum a-posteriori p_{post} = 1 implying a strictly linearly decreasing function:[6]

$$\begin{aligned} \Delta p\big|_{b=0} &= p_{post}\big|_{b=0} - p_{prior} \\ &= 1 - p_{prior} \text{ with } p_{prior} \in (0;1] \end{aligned} \tag{14}$$

The situation changes when managers do not signal the underlying persistence perfectly. If they begin erroneously to support transitory earnings changes with a confirming dividend ($b > 0$), the signal will become ambiguous and investors cannot determine uniquely whether they face a persistent or a transitory, unexpected earnings change. This imprecision has two effects. It both reduces the general value of the dividend signal and implies the inverse u-shape of Δp. Figure 3 depicts both the benefits of a perfect and an imperfect dividend signal.

[Figure 3]

In the case of an imperfect dividend signal, the incremental benefit is relatively small for low a-priori assessments ($p_{prior} < p_{prior}^{max}$). The reason is that investors face two contradictory information signals in this situation. When first observing the earnings change, investors classify the persistence as low. Management then sends an additional information signal which, by contrast, underpins the persistence of the earnings change. However, the dividend signal is not generally a perfect indicator of earnings persistence. In this situation of two conflicting, imperfect pieces of information, investors are not particularly confident in the updating dividend

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[6] An exception occurs for p_{prior} = 0. As Figure 2 shows, a persistent earnings change is not possible if investors a-priori believe with certainty that the faced earnings change is purely transitory. Therefore, in this case, the function is not defined.

signal and therefore do not deviate much from their a-priori assessment. The beneficial effect of the dividend signal steadily increases the smaller the gap between the "negative", first assessment and the "positive" dividend signal is. Hence, the dividend signal's benefits increase, the higher the level of a-priori investor assessments. At p_{prior}^{max} the dividend signal achieves its greatest effect. At this point, the incremental information from the dividend complements the a-priori information most suitably. For all a-priori assessments which exceed p_{prior}^{max}, the dividend's incremental effect gradually declines as the assessed probability of earnings persistence is limited on the upside. Both information signals point in the same direction and hence confirm each other, but investors can maximally update their a-posteriori probability to a maximum of one. In conclusion, the uncertainty of the dividend signal implies a deviation from the monotonic effect for a perfect dividend signal and leads to an inverse u-shaped relationship.

In the next step, we will analyze the dependency of Δp on the parameters a and b, which determine the degree of uncertainty of the dividend signal and hence the value of the confirming dividend:[7]

$$\frac{\partial \Delta p}{\partial a} = \frac{p_{prior} \cdot \left(1 - p_{prior}\right) \cdot b}{\left[p_{prior} \cdot a + \left(1 - p_{prior}\right) \cdot b\right]^2} > 0 \tag{15}$$

and

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[7] The maximum benefit is a theoretical corner case for $b = 0$ and is independent of a, so that it is irrelevant for the following analysis.

$$\frac{\partial \Delta p}{\partial b} = -\frac{p_{prior} \cdot \left(1 - p_{prior}\right) \cdot a}{\left[p_{prior} \cdot a + \left(1 - p_{prior}\right) \cdot b\right]^2} < 0 \tag{16}$$

The parameters *a* and *b* act as counterparts so that, if parameter *a* increases, firms will rather support persistent earnings changes, thus inducing a higher reassessment Δ*p*. On the other hand, if *b* increases, managers will further support transitory earnings changes and the signal becomes more obscure, leading to a lower reassessment Δ*p*. Thus, investor reassessment is stronger, the lower the uncertainty of the signal achieved by a) a ceteris paribus increase in *a*, b) a ceteris paribus decrease in *b* or c) by interfering with these two effects. A further property is that the location of the maximum shifts steadily to the left, if risk is reduced:

$$\frac{\partial p_{prior}^{max}}{\partial a} = -\frac{\left(\sqrt{0.5 \cdot a} - \sqrt{0.5 \cdot b}\right)^2}{\sqrt{\frac{a}{b}} \cdot \left(a - b\right)^2} < 0 \tag{17}$$

and

$$\frac{\partial p_{prior}^{max}}{\partial b} = \frac{\left(\sqrt{0.5 \cdot a} - \sqrt{0.5 \cdot b}\right)^2}{\sqrt{\frac{b}{a}} \cdot \left(a - b\right)^2} > 0 \tag{18}$$

Altogether, the function Δ*p* becomes more and more “skewed” and steadily approaches the maximum benefit 1 - p_{prior}, when the uncertainty of the dividend signal decreases. It also can be shown that the impact of *b* outweighs the effect of parameter *a*. This result can already be assumed from the above reasoning. Parameter *b* determines whether or not there is risk associated with the signal. For $b = 0$, the signal becomes unique and Δp conforms to the maximum benefit. For all $b > 0$, the signal becomes ambiguous and a high parameter a can reduce this uncertainty, but not eliminate it completely, not even in the case of $a = 1$.

In summary, the analysis based on the Bayesian Model provides the following insights. The benefit of a confirming dividend signal which updates investor preassessment of earnings persistence relies on the state of a-priori investor information. Firstly, the analysis reveals that the incremental dividend benefit is an inverse u-shaped function of a-priori investor assessment. That is, the confirming dividend is most important to investors, when their a-priori belief in earnings persistence is moderate, rather than low. The reason for this non-monotonic relationship is the imperfection of the dividend signal. If management does not perfectly reveal earnings persistence with its dividend decision, investors are not willing to deviate much from a low a-priori assessment which counteracts the good news by the dividend signal. Secondly, when the uncertainty of the dividend signal is lowered, investor reactions to the confirming dividend steadily increase for all a-priori assessments and converge to the monotonic effect of a perfect dividend signal. Also, the curvature of the revision becomes more pointed and skewed. That is, the maximum effect increases and is realized for steadily lower a-priori assessments.

In our empirical analysis, we test for both these properties. Firstly, we analyze whether, conditional on a-priori investor assessment, the incremental benefit of a confirming dividend change yields an inverse u-shape. Secondly, we examine whether this relationship converges to a monotonically decreasing relationship, when we restrict our sample to increasingly more reliable dividend signals.

Our theoretical results are compatible with the more general, partial equilibrium model of Holthausen and Verrecchia (1988). In a multi-asset, two-period model, they analyze the impact of new information on prices when it is conveyed to the market. Similarly to our setting, investors receive two consecutive information signals about a risky asset. The first signal has already been released to the market. If the second contains any relevant, new information about the risky asset, it should provoke a corresponding price reaction. Specifically, Holthausen and Verrecchia (1988) use the variance of the induced price change as an indicator of the importance of the second information signal. The new information is the more relevant and/or reliable, the stronger the market response to the new information. In their analysis, the influence of both signals' qualities on their interaction effect is crucial, where quality is defined as the precision of an information signal. That is, an information signal is of higher quality, the more it reveals the firm's true, underlying value. In our model, we consider an analogous quality concept for the second information signal (dividends). The dividend signal is higher quality, if it communicates earnings persistence more reliably. For our first information signal (earnings), we rely on a slightly different characterization. Specifically, we do not explicitly capture the quality of the first information signal, but refer to investor perceptions of the underlying quality, whereby earnings are high (low) quality, if they are persistent (transitory). Despite this different quality concept, we obtain similar theoretical results as in Holthausen and Verrecchia's (1988) general model. The authors show first that a deterioration in the quality of the second information signal means that this information release does not become more important for investors. In our model, we similarly observe a decline in the benefit of the updating dividend signal, when its quality decreases (e.g. through an increase in parameter b). Secondly, Holthausen and Verrecchia (1988) analyze the comparative statics when changing the quality of the first information release. They find that the quality of the first signal has no general, monotonic impact on the variance of price change. Instead, it depends on the specific correlation structure between both information signals. Our model, with the derived inverse u-shaped relationship, provides a specific example of such a non-monotonic influence. Thirdly, Holthausen and Verrecchia (1988) discuss sufficient conditions for arriving at a unique (or monotonic) relationship. One sufficient condition is the case of intertemporal sufficiency, a constellation in which the updating information signal contains at least as much information as the first one. When the quality of the first information signal is reduced in this situation, the importance of the following information signal does not become less important. In our setting, a perfectly revealing dividend signal is intertemporally sufficient, as it subsumes investors' a-priori information entirely. We then arrive at a monotonically decreasing relationship analogously to Holthausen and Verrecchia (1988).

3. Sample Criteria, Variable Measurement, and Descriptive Statistics

Our theoretical model and the derived hypotheses extend Koch and Sun's (2004) findings about the incremental benefit of a confirming dividend change. Hence, our sample criteria and variable measurement are closely aligned with their research design. Our sample contains firms which announced quarterly cash dividends between 1983 and 2006.[8] The dividend and price information are included in the Center for Research in Security Prices (CRSP) files, required earnings and balance sheet information are recorded in the Compustat quarterly files and firm-size decile returns are retrieved from the Kenneth R. French Data Library. Table 2, Panel A, provides a concise overview of the applied sample criteria.

[Table 2]

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[8] Because of the financial crisis from 2000 to 2002, we exclude any observations made in this period from our sample.

Between 1983 and 2006 – excluding any observation between 2000 and 2001– we obtain a total of 31,469 quarterly dividend changes. Requiring quarterly earnings information (net income before extraordinary items and the corresponding reported date on quarterly earnings) from Compustat for eight quarters prior to and eight quarters after the announced dividend change, reduces the sample to 19,574 observations. Eliminating dividend changes which did not occur on a business day and with a prior earnings change of zero, requiring market value and return information from CRSP and the Kenneth R. French Data Library respectively, further reduces the sample to 17,829 observations. In order to separate the announcement effects of the dividend and the preceding earnings change, we eliminate all observations where the declaration of the dividend change and of the earnings change fall within 10 days. Altogether, we obtain 12,501 observations which form the unconditional sample. In order to test our hypotheses concerning the incremental benefit of a confirming dividend change conditional on a-priori investor assessment, we additionally need a measure of prior investor knowledge. We proxy a-priori investor assessment of the persistence of the preceding earnings change by past time-series persistence. In order to estimate our main, quarterly persistence measure, we need additional earnings and balance sheet information (net income before extraordinary items and total assets) from Compustat, which leads to our (main) conditional sample consisting of 8,635 observations.

Panel B of Table 2 shows the partition of the conditional (unconditional) sample, where we differentiate between confirming (dividend and earnings change have the same sign) and contradictory (dividend and earnings change have the opposite sign) dividend changes. Our conditional (unconditional) sample contains 6,033 (8,789) confirming dividend increases and 296 (438) confirming dividend decreases, implying a total of 6,329 (9,227) confirming dividend changes. The proportions of both samples are close to the values reported by Koch and Sun

(2004). In their sample consisting of 6,395 dividend changes between 1983 and 1999, they observe 92.1 percent dividend increases (our unconditional (conditional) sample: 93 percent (93.1 percent)) and 73.4 percent confirming dividend changes (our unconditional (conditional) sample: 73.8 percent (73.3 percent)).

Panel C reveals the descriptive distributions of the key variables in our study. Investor price reaction inferred through the quarterly dividend change is quantified by the dependent variable $CAR_{t,i}$.[9] The variable represents the cumulative abnormal return around the dividend announcement for firm *i*, measured as the sum of five abnormal daily returns from two days prior to until two days after the dividend announcement at *t*.[10] The corresponding preceding earnings change is represented by $\Delta QEARN_{t,i}$. It is assumed that the unexpected (quarterly) earnings change can be represented as a seasonal random walk change. Hence, $\Delta QEARN_{t,i}$ is calculated as the difference between the quarterly earnings announcement before the declaration of the quarterly dividend change at *t* and the quarterly earnings announcement in the same quarter of the prior year. The variable is then deflated by the market value at the beginning of the 5-day period surrounding the dividend change. In two further specifications, we alter the measurement of the preceding earnings change. The variable $\Delta QEARN_{t,i}^{2}$ is the sum of the prior two seasonal random walk earnings changes, deflated by the market value at the beginning of the 5-day period surrounding the dividend change. When relying on this definition in our analysis, we determine the incremental benefit of the dividend change in signalling the persistence of a longer-term earnings development. The third specification, $\Delta QEARN_{t,i}^{2,\text{all}}$, is also a longer-term earnings change, computed as the sum of the last two quarterly earnings changes, but additionally, we

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[9] Table 1 provides a full description of all variables in our study.

[10] Abnormal returns are calculated as size-adjusted daily returns using equally-weighted firm-size decile returns.

require that both prior quarterly earnings changes have the same sign. This additional requirement may influence the confirmatory benefit of the dividend change as in this case, both the preceding earnings changes and the dividend change have the same sign. The control variable $\Delta FUTURE_{t,i}$ is introduced in order to separate the effect of investor revisions of earnings persistence from future earnings growth. Both effects address similar future consequences, but they are still not congruent. The persistence of a considered earnings change does not necessarily imply future earnings growth. Persistence is rather seen as a tendency that the faced (unexpected) earnings change is less likely to reverse in future periods. For instance, an unexpected current earnings increase is said to be persistent, if the earnings increase is less likely to reverse into future earnings decreases. Hence, the persistence of an earnings change is a positive characteristic of future earnings developments, but still more conservative than an explicit future earnings growth. In order to focus on the effect of investor revisions of earnings persistence, the control variable $\Delta FUTURE_{t,i}$ captures the anticipation of future earnings growth in the dividend signal. The variable is computed as the sum of the eight quarterly seasonal random walk earnings changes declared after firm's *i* announcement of the dividend change at *t*. This variable is also deflated by the market value at the start of the 5-day period surrounding the announced dividend change at *t*. The relative size of the dividend change $\Delta DIV_{t,i} / \Delta QEARN_{t,i}$ is defined as the ratio of the total dollar amount of the quarterly dividend change (scaled by market value) to the preceding quarterly earnings change (scaled by market value). This variable is used to isolate stronger and more reliable dividend signals. High, absolute values of $\Delta DIV_{t,i} / \Delta QEARN_{t,i}$ are interpreted as strong signals of earnings persistence.

The empirical distributions of $CAR_{t,i}$, $\Delta QEARN_{t,i}$, $\Delta FUTURE_{t,i}$ and the relative dividend size $\Delta DIV_{t,i}$ / $\Delta QEARN_{t,i}$, which are also reported by Koch and Sun (2004), are almost congruent with their values. The last three rows of Panel C contain the statistics of our main persistence measure, as well as two alternative specifications which proxy for a-priori investor assessment about earnings persistence. These metrics capture earnings persistence directly, by analyzing the time-series behavior of past earnings. Firstly, we measure earnings persistence as the estimated firm-specific slope coefficient $\alpha_{1,i}$ of a regression of firm *i*'s earnings in quarter *q* on quarterly earnings of the same quarter in the preceding year:[11]

$$QEARN_{q,i} = \alpha_{0,i} + \alpha_{1,i} \cdot QEARN_{q\text{-}4,i} + \varepsilon_{q,i} \tag{19}$$

Earnings are defined as quarterly net income before extraordinary items, deflated by yearly average total assets. The earnings variable is then winsorized at the 1- and 99-percentiles. We estimate regression (19) for each firm *i* and each quarter *q*, with a rolling regression technique from Francis et al. (2004) and a time window of ten years. For each rolling window, we require at least six observations of earnings information. Because the distance between two quarterly earnings numbers is one year, we refer to this model as the "lag 1"-specification. The persistence parameter α_1 quantifies how strongly one-year ahead earnings are affected by current earnings. If future earnings are sustainably influenced by current earnings, the corresponding persistence parameter α_1 is relatively high, whereas a small α_1 indicates relatively transitory earnings. The presented procedure yields estimated time-series persistence parameters for each firm *i* and each dividend change announcement at *t* ($TP_{t,i}^{\text{lag1}}$).

In further specification tests, we use two alternative, estimated persistence parameters. Analogous to Skinner and Soltes (2010), we additionally prolong the distance between two

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[11] An analogous measure is used in Skinner and Soltes (2010) who find that dividend paying firms generally have more sustainable earnings streams than non-dividend payers.

consecutive earnings numbers to two years ("lag 2"-specification). The earnings persistence parameter α_1 then captures the influence of current quarterly earnings information on the two-year-ahead quarterly earnings information. Past time-series persistence ($TP_{t,i}^{\text{lag2}}$) is the estimated firm-specific slope coefficient $\alpha_{1,i}$ of a regression of firm *i*'s earnings in quarter *q* on quarterly earnings of the same quarter two years back:

$$QEARN_{q,i} = \alpha_{0,i} + \alpha_{1,i} \cdot QEARN_{q\text{-}8,i} + \varepsilon_{q,i} \qquad (20)$$

As a final specification, we estimate model (19) and change the deflator of the earnings variable. That is, *QEARN* corresponds to quarterly earnings per share before extraordinary items, adjusted for stock splits. We refer to these estimated persistence parameters as $TP_{t,i}^{\text{eps}}$.

The mean earnings persistence parameter of $TP_{t,i}^{\text{lag1}}$ is 0.359, which implies that one-year-ahead earnings can be explained by almost a third of current quarterly earnings on average. Thus, two-year-ahead quarterly earnings should be explainable by 0.359^2 of current quarterly earnings. The descriptive statistics confirm this property as the mean of $TP_{t,i}^{\text{lag2}}$ is 0.126, which is roughly the square of 0.359. The estimated, past persistence parameters using earnings per share ($TP_{t,i}^{\text{eps}}$), are higher throughout than $TP_{t,i}^{\text{lag1}}$, resulting in a mean past earnings persistence of 0.598 (compared to 0.359 for $TP_{t,i}^{\text{lag1}}$). Furthermore, the standard deviation of $TP_{t,i}^{\text{eps}}$ (0.515) is higher than the standard deviation of $TP_{t,i}^{\text{lag1}}$ (0.419).

4. Cross-Sectional Tests for the Conditional Revision of Earnings Persistence

Our empirical design extends Koch and Sun's (2004) main regression equation, which captures the unconditional investor revision of earnings persistence around the announcement of the dividend change. In our analysis, we examine the differences in the revision, when conditioning on a-priori investor assessment which is proxied by estimated, past times-series persistence. Specifically, we run the following regression:

$$\begin{aligned} CAR_{t,i} = {} & \alpha + \alpha_L \cdot LDUM_{t,i} + \alpha_M \cdot MDUM_{t,i} + \beta_L \cdot \Delta QEARN_{t,i} \cdot LDUM_{t,i} \\ & + \beta_M \cdot \Delta QEARN_{t,i} \cdot MDUM_{t,i} + \beta_H \cdot \Delta QEARN_{t,i} \cdot HDUM_{t,i} \\ & + \gamma \cdot \Delta FUTURE_{t,i} + \varepsilon_{t,i} \end{aligned} \qquad (21)$$

All independent variables are winsorized at the 1- and 99-percentiles. We differentiate our conditional sample into three subsamples, according to estimated past time-series persistence ($TP_{t,i}^{\text{lag1}}$). The third of the firms with the worst $TP_{t,i}^{\text{lag1}}$ values represents the low-persistence subsample (*L*), the third with the best $TP_{t,i}^{\text{lag1}}$ values, the high-persistence subsample (*H*), and the remaining third with mediocre $TP_{t,i}^{\text{lag1}}$ values forms the moderate-persistence subsample (*M*) respectively. For each of these subsamples, we estimate the differential ERC β which quantifies investor reassessment of earnings persistence induced through the confirming dividend change. As outlined in the theoretical model, the β-coefficients should be all greater than zero, as they are driven by the positive differential between p_{post} and p_{prior}. Conditioned on $TP_{t,i}^{\text{lag1}}$, the coefficient β_L represents the differential ERC, estimated for the low-persistence subsample, β_M and β_H correspondingly, the differential ERCs for the moderate and high-persistence subsamples. The variables *LDUM*, *MDUM* and *HDUM* are all dummy variables, taking on the value one if firms belong to the low (*LDUM*), moderate (*MDUM*) or high $TP_{t,i}^{\text{lag1}}$ subsample (*HDUM*).[12] Otherwise, the dummy variables are zero.

According to our theoretical analysis, we expect the β-coefficients to be statistically different for the three subsamples. Specifically, we assume an inverse u-shaped relationship. That is, the coefficient for moderate-persistence firms (β_M) should be greater than the corresponding coefficients for low (β_L) and high-persistence firms (β_H). In order to prevent bias in the estimation of the beta coefficients, we allow the intercept of the regression to vary with the different $TP_{t,i}^{\text{lag1}}$ subsamples. The coefficients α_L and α_M then control for incremental level effects of $TP_{t,i}^{\text{lag1}}$, compared to the high-persistence subsample. The remaining coefficient γ quantifies the anticipated extent of future earnings growth.

In the next step, we test the behavior of conditional investor revisions when the dividend signals steadily become more reliable. Within our theoretical model, more reliable dividend signals are equivalent to altering probability a and/or lowering probability b. The equations (15) to (18) capture the theoretical consequences on investor revisions of earnings persistence. (15) and (16) constitute a "level effect", that is, stronger or more reliable dividend signals generally induce a higher revision of earnings persistence. Hence, we assume that the hypothesized difference between β_L, β_M and β_H becomes more apparent when management sends stronger dividend signals. By contrast, equations (17) and (18) establish a "skewness effect". The inverse u-shaped relationship remains, but gradually becomes more skewed to the right when enhancing the strength of the dividend signal. If the risk of the dividend signal converges to zero, the dividend

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[12] Instead of using three dummy variables, we could also rely on two dummy variables, e.g. one for the moderate and high *TP* subsample respectively. In this case, the coefficients β_M and β_H would represent the increments in the differential ERC, in comparison to the low *TP* subsample. Both procedures are equivalent and yield the same results.

signal tends towards a perfectly revealing signal. In this case, the inverse u-shape is replaced by a monotonically decreasing relationship. Our empirical analysis first reveals whether a level effect is observable, and then whether it succeeds in extracting sufficiently strong dividend signals to induce a prevailing skewness effect. In our analysis, we proxy the reliability or strength of the dividend signal in communicating earnings persistence, by the relative size of the dividend change ($\Delta DIV_{t,i} / \Delta QEARN_{t,i}$). As outlined above, management alters its dividend policy only when confident in maintaining the new dividend level permanently. That is, management is firmly convinced that the preceding earnings change will persist into future periods. A large dividend change, compared to the preceding earnings change, may then be interpreted as a strong or reliable signal of earnings persistence. Accordingly, Koch and Sun (2004) provide evidence that the unconditional investor revision of earnings persistence increases monotonically with the relative size of the dividend change, which is consistent with an existing level effect. In order to analyze the behavior with respect to strong dividend signals, we eliminate from the unconditional confirmatory sample, the observations with the 25 percent, 50 percent and finally, the 75 percent weakest dividend signals, measured by the relative size of dividend change ($\Delta DIV_{t,i} / \Delta QEARN_{t,i}$). We then estimate, for each of these subsamples, past time-series persistence according to $TP_{t,i}^{\text{lag1}}$, $TP_{t,i}^{\text{lag2}}$ and $TP_{t,i}^{\text{eps}}$ respectively. Finally, we run regression test (22) on these restricted samples and examine whether the inverse u-shaped relationship becomes more distinct, or whether we in fact observe a monotonically decreasing relationship ($\beta_L > \beta_M > \beta_H$).

5. Empirical Results

In this Section, we report the results of our regression analysis on the conditional investor revision of earnings persistence. Firstly, we report the results for our main, conditional sample for which we use the one quarter, seasonal random walk earnings change $\Delta QEARN_{t,i}$ and past time-series persistence defined by $TP_{t,i}^{\text{lag1}}$. In the next step, we alter the definition of the preceding earnings change ($\Delta QEARN_{t,i}^{2}$ and $\Delta QEARN_{t,i}^{2,\text{all}}$ respectively). With these specifications, we analyze whether the conditional revision of earnings persistence through a confirming dividend signal changes when relying on a preceding, longer-term earnings change definition. Both alternative earnings changes that we consider are defined as the sum of the prior two quarterly earnings changes preceding the dividend signal. In the case of $\Delta QEARN_{t,i}^{2,\text{all}}$ we additionally specify that both quarterly earnings changes have the same sign as the confirming dividend signal. The incremental benefit of a dividend change which confirms both preceding earnings changes may be assessed as an even more reliable signal of earnings persistence by investors, as it confirms a broader history of earnings changes. This argument is motivated by Freeman and Tse (1989), who provide evidence that investors use several quarters of subsequent earnings information in order to assess the persistence of an observed earnings innovation. In particular, they show that investor assessment of earnings persistence is affected by the frequency of subsequent, confirmatory information. In the next specification, we check whether our results depend on the choice of estimated, past time-series persistence and use two alternative measures ($TP_{t,i}^{\text{lag2}}$ and $TP_{t,i}^{\text{eps}}$ respectively) in order to proxy for a-priori investor assessment. In the subsequent sensitivity test, we examine whether our results are influenced by additionally controlling for dividend size in the regression. The literature provides evidence that the abnormal returns around a dividend announcement can be explained by the size of dividend announced. For instance, Bajaj and Vijh (1990) find a statistically significant relationship between the abnormal returns surrounding a dividend change and dividend yield, due to clientele effects. That is, some investors explicitly prefer dividend payments, whereas others do not. The first (second) group of investors prefers to invest in high (low) dividend yield stocks, such that empirically stronger reactions are observed for high-dividend-yield stocks. Koch and Sun (2004) argue that if the market reaction to a dividend change is driven largely by the dividend size, the preceding earnings change might serve as a proxy for the subsequent dividend change. In our analysis, we include both their proxies for dividend size, the dividend change deflated by market value ($\Delta DIV_{t,i}$) and the dividend change deflated by the preceding dividend amount ($\%\Delta DIV_{t,i}$).

In a final test, we determine whether our model is also valid in capturing the conditional effects of contradictory dividend changes. Koch and Sun (2004) show that investors interpret a dividend change with the opposite sign to that of the preceding earnings change, as a contradictory signal of earnings persistence. Investors then reduce their a-priori assessment of earnings persistence. That is, their a-posteriori probability p_{post} after the contradictory dividend signal is below their a-priori assessment p_{prior}, which leads to a negative revision Δp. According to (3), a negative revision Δp implies a negative incremental ERC β, meaning that, for example, investors revise their positive a-priori reaction to an earnings increase downwards when observing a dividend decrease. Koch and Sun's (2004) empirical results confirm this unconditional reaction to contradictory dividend changes. Analogously, this reaction can be conditioned on a-priori investor assessment. Following the same procedure as in Section 2, our model implies a u-shaped relationship, as depicted in Figure 4.

[Figure 4]

The key result remains valid, as investors revise their preassessment most strongly, if they believe a-priori in moderate earnings persistence. The non-monotonic effect is again attributable to the imperfect dividend signal. When managers succeed in signalling earnings persistence more reliably, the u-shaped relationship converges to a linearly decreasing function. In this corner case, the dividend signal perfectly reveals earnings persistence and investors revise their preassessment most strongly when their a-priori assessment is high. We analyze the conditional effect of contradictory dividend changes by running model (21) on the contradictory sample, while estimating past time-series persistence by $TP_{t,i}^{\text{lag1}}$.

5.1. Results for the Conditional Effect on the Confirmatory Dividend Sample

In Table 3, we report the results with respect to the conditional investor reaction to confirming dividend changes, while firms' time-varying persistence parameter is estimated with the one-year time lag according to model (19). First, we run the regression on the whole sample, consisting of all positive and negative confirming dividend changes ("All"). The next step is to test our hypothesis on the "25%", "50%" and "75%" sample with gradually stronger dividend signals.

[Table 3]

The results for the whole confirmatory sample confirm our hypothesis that the revision of earnings persistence does not depend monotonically on the a-priori investor assessment. Instead, the relationship is inverse u-shaped, as predicted. We measure the highest differential ERC for firms which are classified as moderately persistent $\left(\beta_M = 0.626\right)$. The corresponding differential ERCs for the low and high-persistence subsamples are 0.244 and 0.411 respectively. Further F-tests show that the differences between $\left(\beta_M, \beta_L\right)$ and $\left(\beta_M, \beta_H\right)$ are significant at the .01 percent and .05 percent levels.[13] According to the relationship between the high and low-persistence subsamples, we make no further predictions when expecting an inverse u-shaped relationship. However, within the "All" sample, the differential ERC β_H is significantly higher than β_L.

The remaining rows in Table 3 show how the relationship between the differential ERCs changes, when we conduct the same regression test on restricted samples with stronger dividend signals. In general, we first expect all differential ERCs to increase and the differences between $\left(\beta_M, \beta_L\right)$ and $\left(\beta_M, \beta_H\right)$ to become even more distinct, when enhancing the strength of the dividend signals (level effect). Secondly, for extremely strong dividend signals, we may even observe a monotonically decreasing relationship between β_L, β_M and β_H (dominant skewness effect). In the second row of Table 4, we report the results for the "25%" sample. The inverse u-shaped relationship remains, however the differences between the coefficients are not statistically significant. As assumed, all three coefficients $\left(\beta_L, \beta_M, \beta_H\right)$ increase, but the inversed u-shape does not become more distinct as the differences between $\left(\beta_M, \beta_L\right)$ and $\left(\beta_M, \beta_H\right)$

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[13] We report the results of one-sided F-tests in Table 4.

remain at the same levels as in the "All" sample.[14] Furthermore, the initially significant relation $(\beta_H > \beta_L)$ disappears almost completely. This property together with a weakening, inversed u-shape might indicate a growing skewness effect. When moving to the "50%" sample with the 50 percent strongest confirmatory dividend signals, all three coefficients increase further and the inverse u-shaped relationship turns into a monotonically decreasing rank order. However, the differences between the differential ERCs are not significant at conventional levels. The strongest dividend signals in the "75%" sample also induce the highest differential ERC for the low-persistence subsample. However, β_M is smaller than β_H so that we do not observe a monotonically decreasing relationship in the sample with the strongest dividend signals.

In summary, Table 3 confirms an inverse u-shaped relationship between β_L, β_M and β_H for all confirmatory dividend changes. The "25%" sample shows that this relationship weakens, as the differences between the beta coefficients are not statistically significant. In contrast to the "All" sample, the coefficient β_H is not significantly higher than β_L anymore. These results of the "25%" sample might indicate an increasing skewness effect. The results for the last two subsamples with the 50 and 25 percent strongest dividend signals do not statistically confirm, but at least tend towards a monotonically decreasing relationship which further emphasizes an increasing skewness effect.

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[14] When we eliminate small dividend changes more conservatively, for instance the 10 percent smallest dividend changes, the inverse u-shape remains statistically significant and the differences between the beta coefficients increase and hence confirm a level effect.

5.2. Results for the Conditional Effect Using Alternative Definitions of Past Earnings Changes

In this subsection, we report the results for the conditional revision of earnings persistence, when relying on the longer-term earnings changes $\Delta QEARN_{t,i}^{2}$ (Table 4, Panel A) and $\Delta QEARN_{t,i}^{2,\text{all}}$ (Table 4, Panel B).

[Table 4]

The first row in Panel A shows the results for all confirming dividend changes, using two-quarter earnings changes $\Delta QEARN_{t,i}^{2}$ in the regression. We again observe an inverse u-shaped relationship and both predicted differences, $(\beta_M > \beta_L)$ and $(\beta_M > \beta_H)$, are significant at the .01 level. The differential ERC of the moderate-persistence subsample, β_M, is 0.350 and the corresponding coefficients of the low and high-persistence subsamples are almost identical (0.161 vs. 0.160). The behavior of the relationship for steadily more reliable dividend signals is similar to Table 3 and tends towards a monotonically decreasing relationship even further. In the "25%" sample, the inverse u-shaped relationship remains significant, but becomes skewed, as β_L is considerably larger than β_H. This property is conformable with an originating skewness effect. This tendency strengthens, when moving to the "50%" and "75%" samples. In the former sample, β_L increases further and converges closer to β_M. Both coefficients (0.422 vs. 0.464) are almost equal and significantly greater than β_H, which further indicates an enhanced skewness effect. The results of the “75%” sample ultimately reveal a monotonically decreasing relationship $(\beta_L > \beta_M > \beta_H)$, which is statistically significant at least for the relation $(\beta_L > \beta_H)$. The results in Panel B for $\Delta QEARN_{t,i}^{2,\text{all}}$ are superior and confirm the findings in Panel A. A highly significant inverse u-shaped relationship is observed in the “All” sample. Then, the inverse u-shaped relationship becomes skewed in the 25% and the 50% samples. In the former, all three pairwise relations between the beta coefficients are statistically significant. In the latter, the skewness effect increases further, as β_L and β_M are very close to each other, and both are significantly greater than β_H. Finally, a monotonically decreasing relationship in the “75%” subsample, with the 25 percent strongest dividend signals, is observed. The differences between $(\beta_L > \beta_M)$ and $(\beta_L > \beta_H)$ are now statistically significant at the .10 and .01 levels respectively.

The results in Table 4 strongly confirm our predictions regarding the general, conditional benefit of a confirming dividend change, as well as its behavior with respect to gradually more reliable dividend signals. At first, one observes an inverse u-shape for all confirming dividend signals. In this case, the confirming dividend change is not interpreted as a perfectly revealing signal, resulting in the hypothesized non-monotonic, inverse u-shaped relationship between the beta coefficients. A further concentration on large dividend changes, compared to the preceding earnings change, induces an increasing skewness effect, which ultimately leads to a monotonically decreasing relationship. The results are even stronger, if longer-term earnings are proxied by $\Delta QEARN_{t,i}^{2,\text{all}}$. In this case, both prior earnings changes have the same sign as the updating dividend change, so that investors are even more confident about the reliability of the dividend signal.

As a sensitivity check, we also implement longer past earnings windows analogously to Koch and Sun (2004). When calculating the longer-term earnings changes as the sum of the last three or four quarterly earnings changes respectively, we obtain similar results to those in Table 4. The results – particularly the convergence to a monotonically decreasing relationship – remain superior, when all earnings changes confirm each other and have the same sign as the updating dividend change.

5.3. Results for the Conditional Effect Using Alternative Specifications for Past Time-Series Persistence

In this Section, we consider whether our results are driven by the measurement of past time-series persistence ($TP_{t,i}^{\text{lag1}}$). In Table 5, Panel A, we estimate past time-series persistence according to the "lag2" specification ($TP_{t,i}^{\text{lag2}}$) and use these estimated parameters to run our conditional tests. Panel B of Table 5 reports the results when past time-series persistence is estimated according to $TP_{t,i}^{\text{eps}}$.

[Table 5]

As Panel A reveals, a partitioning of the confirmative dividend signals according to $TP_{t,i}^{\text{lag2}}$ also yields robust results as well. In all samples, we find strong support for an inverse u-shaped relationship between β_L, β_M and β_H. Contrary to the $TP_{t,i}^{\text{lag1}}$ measure, the inverse u-shaped relationship becomes steadily more distinct when we move to stronger dividend signals. That is, we observe only an increasing level effect.

In Panel B we return to the “lag1” specification while estimating past time-series persistence based on earnings per share (eps). Again, the “All” sample is characterized by an inverse u-shaped relationship which is significant at the .05 level. The relationship becomes skewed in the 25% sample and then turns into a monotonically decreasing rank order for the following subsamples. Furthermore, the decreasing relationship between the differential ERCs is generally statistically significant.

Compared to our results in Panel A and Table 3 respectively, past time-series persistence measured by $TP_{t,i}^{\mathrm{eps}}$ generates a relatively strong skewness effect. A reason may be deducted from the descriptive statistics.[15] Estimated past time-series persistence by $TP_{t,i}^{\mathrm{eps}}$ exceeds the corresponding values by $TP_{t,i}^{\mathrm{lag1}}$ throughout all reported percentiles. Especially the first quartile of $TP_{t,i}^{\mathrm{eps}}$ (0.224) is considerably greater than the first quartile of $TP_{t,i}^{\mathrm{lag1}}$ (0.082). Firms which are assigned to the low-persistence subsample (*L*) according to $TP_{t,i}^{\mathrm{eps}}$ are still characterized by relatively high, past time-series persistence parameters, compared to firms which are classified by $TP_{t,i}^{\mathrm{lag1}}$ into the low-persistence subsample. Hence, investors might assess the indicated low earnings persistence in the latter case considerably stronger than in the former. Thus, the inversed u-shape turns rather easily into a monotonically decreasing relationship, when firms are partitioned by $TP_{t,i}^{\mathrm{eps}}$. A converse reasoning seems to explain the results for $TP_{t,i}^{\mathrm{lag1}}$ compared to $TP_{t,i}^{\mathrm{lag2}}$. Past time-series persistence estimated by $TP_{t,i}^{\mathrm{lag2}}$ measures longer-term earnings persistence, as it quantifies the influence of an actual earnings number on two-years-ahead earnings. When assuming stationary, autoregressive earnings processes, the influence of current earnings information on future earnings should decline over time. The descriptive statistics of

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[15] Compare Table 2, Panel C.

$TP_{t,i}^{\text{lag}2}$ reveal that all percentiles are smaller throughout than the corresponding percentiles of $TP_{t,i}^{\text{lag}1}$. Particularly the first quartile of $TP_{t,i}^{\text{lag}2}$ is negative (-0.144), implying a negative influence of current earnings on future earnings, whereas the first quartile of $TP_{t,i}^{\text{lag}1}$ is small, but positive (0.082). Hence, investors might assess the persistence of firms assigned to the low-persistence subsample significantly worse, in the case of $TP_{t,i}^{\text{lag}2}$. This might explain the absence of a skewness effect in Panel A. The a-priori investor assessments of earnings persistence, deducted from $TP_{t,i}^{\text{lag}2}$, are extremely low, so that even extremely strong dividend signals cannot convince investors of the converse.

Altogether, the results with alternative measures of past time-series persistence confirm our main hypothesis and provide strong evidence of an inverse u-shaped relationship in general. However, a dominance of either a level or skewness effect, when restricting the sample to gradually stronger dividend signals, seems to depend on the different characteristics of estimated past time-series persistence. If a measure produces extremely low (or even negative) persistence parameters, investors will not deviate much from their "negative" preassessment, with the consequence that even strong, confirming dividend changes are not sufficient to induce a skewness effect. By contrast, if firms which are classified as low-persistence exhibit relatively high past time-series persistence, modest dividend signals will suffice to induce a significant skewness effect.

5.4. Results for the Conditional Effect Including Controls for Dividend Size

In this Section, we analyze the robustness of our results, when introducing controls for dividend size into our conditional tests. As documented by Koch and Sun (2004), the unconditional revision of earnings persistence through a confirming dividend signal remains significant, if dividend size is controlled for explicitly. However, the inclusion of dividend size substantially lowers the unconditional reaction. If the unconditional revision is reduced to a large extent, the hypotheses on the conditional effect might also be influenced heavily. Hence, we test whether the inverse u-shape and the tendency to converge to a decreasing relationship for strong dividend signals are still observable, when we add controls for dividend size to the model (21).

[Table 6]

In Panel A of Table 6, dividend size is measured by $\Delta DIV_{t,i}$ whereas in Panel B, dividend size is proxied by the percentage change $\%\Delta DIV_{t,i}$. Compared to the results in Table 3, without proxying for dividend size, the results remain qualitatively identical in both Panels. In the “All” sample, we observe a highly significant inverse u-shaped relationship. This relationship is attenuated when turning to the “25%” sample with slightly enhanced dividend signals. Increasing the strength of the dividend signal even further, leads to a decreasing relationship in the “50%” samples whereas the unpredicted u-shaped rank order in the “75%” samples remains constant. Similarly to the decline in the unconditional effect documented by Koch and Sun (2004), we also observe a general decline of the differential ERCs β_L, β_M and β_H when adding controls for dividend size. However, the inclusion of dividend size does not alter our general findings.

5.5. Contradictory Dividend Changes and the Conditional Revision of Earnings Persistence

Finally, we test whether our model is also viable for deducting the conditional effects for dividend changes which have the opposite sign of the preceding earnings change and therefore contradict it. We run model (21) on our main, contradictory sample and estimate past time-series persistence by $TP_{t,i}^{\text{lag1}}$. We expect all three beta coefficients to be negative, while the coefficient for the moderate-persistence sample should be the lowest. When enhancing the strength of the dividend signal, we expect the u-shaped relationship to become more distinct (prevailing level effect) or to tend towards a linearly decreasing relationship (prevailing skewness effect).

[Table 7]

In the “All” sample, which contains all contradictory earnings/dividend changes, we detect a u-shaped relationship, as $(\beta_L > \beta_M)$ and $(\beta_H > \beta_M)$ are significant at the .05 level. The coefficient for moderate-persistence firms, β_M, is statistically below zero, whereas β_L and β_H are not statistically different from zero. In the following two subsamples, “25%” and “50%” with gradually stronger dividend signals, the rank order of the estimated beta coefficients rather tends towards a decreasing relationship, as β_M and β_H are relatively close to each other. The subsample “75%”, with the strongest dividend signals, then reveals a significant u-shaped relationship.

Overall, we observe a u-shaped relationship, as predicted by the model. In some subsamples with stronger dividend signals, we even observe a slight movement towards a decreasing relationship. However, when we systematically drop weak dividend signals from the sample, the behavior of the u-shaped relationship yields no clear-cut tendency to converge to a monotonically decreasing relationship.

6. Conclusions

This study examines the incremental benefit of dividend changes in signalling earnings persistence, when taking into account additional information about earnings persistence, which comprises past earnings time-series. We clarify the relevance of an additional information signal (dividends), which updates a preceding information signal (earnings), conditional on investors' prior knowledge (past time-series persistence). Specifically, we extend Koch and Sun's (2004) findings that dividends are interpreted as a confirming signal about earnings persistence of a preceding earnings change, and analyze how the benefit of the dividend signal depends on the a-priori investor assessment. As a proxy for the investors' a-priori information set, we use estimated, past earnings time-series persistence. At first glance, counterintuitively and in contrast to a similar study by Mikhail et al. (2003), the dividend signal is generally not optimally useful, if past time-series persistence is low. A simple Bayesian model shows that the importance of the dividend signal depends both on the a-priori assessment of earnings persistence and the reliability of dividend information. The fact that the dividend signal itself is not a perfect indicator of earnings persistence leads to a non-monotonic, inverse u-shaped relationship between the benefit of the dividend signal and past time-series persistence. Only if the reliability of the dividend signal is enhanced steadily, does the inverse u-shaped relationship converge to a monotonically decreasing relationship. In the corner case of a perfectly revealing dividend signal, investors then react most strongly when they believe a-priori in low earnings persistence.

Our empirical results strongly confirm our predictions. We find evidence that in general, a confirming dividend signal is most valuable if firms are classified a-priori as moderately persistent firms. We also find a tendency for this relationship to turn into a monotonically decreasing relationship, if one restricts the sample to gradually stronger and more reliable dividend signals. In the case of sufficiently strong dividend signals, the benefit of a confirming dividend signal might then be highest when the a-priori investor assessment is low.

Finally, we analyze the incremental importance of a contradictory dividend signal, that is, a dividend increase (decrease) which follows an earnings decrease (increase). In this case, the new information (dividends) contradicts the old information (earnings) and leads to a revision of expectations in the reverse direction. Complementary to the case of confirming dividend changes, our model predicts a non-monotonic, u-shaped relationship in general. That is, the strongest (negative) revision occurs when investors believe a-priori in moderate persistence. Analogously, this non-monotonic relationship tends theoretically towards a monotonically decreasing relationship, when the reliability of the dividend signal is improved steadily. However, our empirical results in the case of contradictory dividend changes only confirm the u-shape, while the behavior for steadily more reliable dividend signals yields no clear trend.

Our findings provide evidence that the benefit of a subsequent information signal is not necessarily negatively correlated to the quality of the first information signal, as hypothesized by many other prior studies. Specifically, we further unravel the relationship between dividends and earnings persistence. In a recent study, Skinner and Soltes (2010) find that dividend-paying firms generally exhibit more persistent earnings than non-dividend-paying firms. Koch and Sun (2004) concentrate on a sample of dividend-paying firms and provide evidence that investors interpret dividend changes with the same (opposite) sign as a preceding earnings change, as a confirming (contradictory) signal about earnings persistence. In our study, we further specify this relationship and find that this incremental effect generally depends non-monotonically on the a-priori investor assessment.

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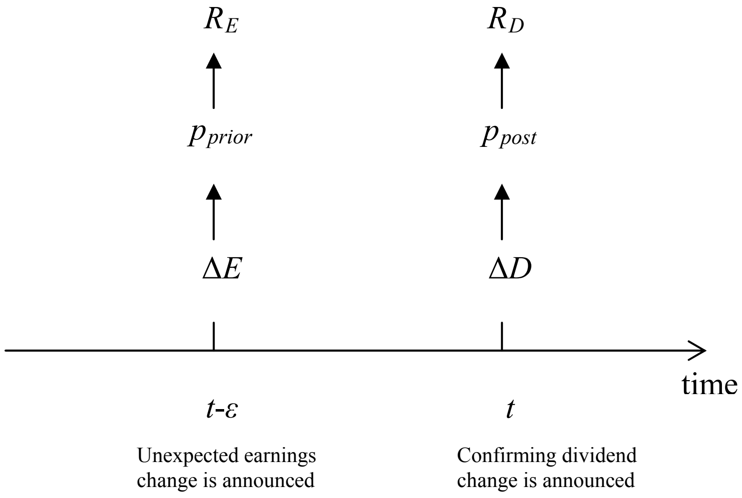
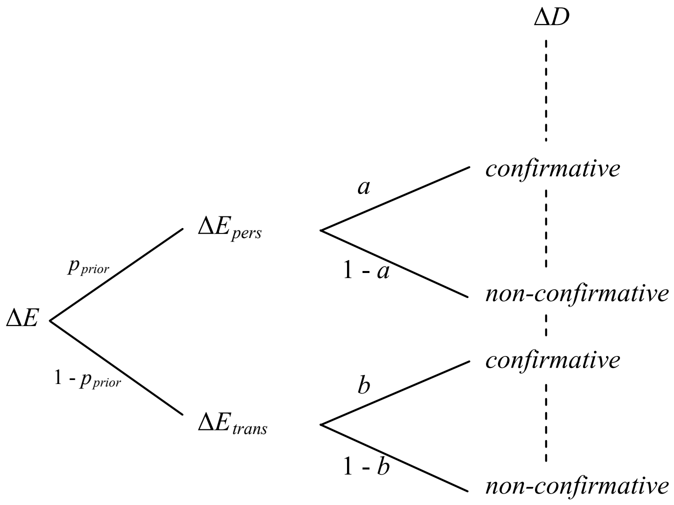


with $\Delta E, \Delta D > 0$ or $\Delta E, \Delta D < 0$

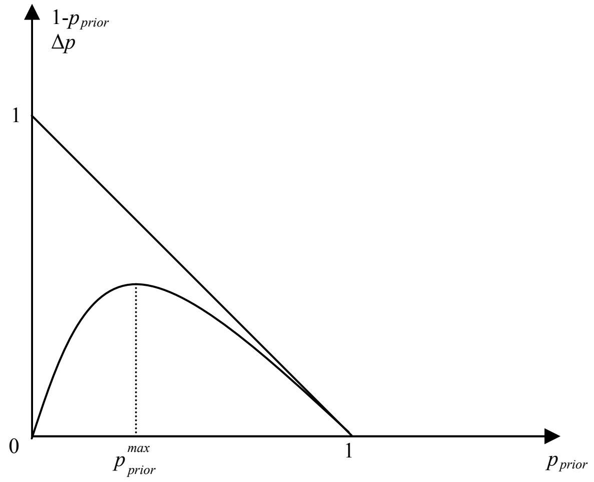
ΔD	Quarterly dividend change	p_{prior}	Investors' prior belief in earnings persistence
ΔE	Quarterly earnings change	p_{post}	Investors' posterior belief in earnings persistence
R_D	Price reaction around the dividend change	t	Point in time at which the dividend change is announced
R_E	Price reaction around the earnings change	t-ε	Point in time at which the earnings change is announced

Figure 1: Assessment and reassessment of earnings persistence and the implied price reactions. Figure 1 shows the sequence and implications of events. Investors first observe an unexpected earnings change ΔE at t-ε. Investors believe, with a probability p_{prior}, that this earnings change will persist, implying a price change R_E of the security. Then, at time t, investors additionally observe a dividend change with the same sign as the preceding earnings change. As the dividend change confirms the preceding earnings signal, investors revise their expectations and believe even more strongly in earnings persistence ($p_{post} > p_{prior}$). This change in probabilities evokes another price reaction R_D around the dividend change.



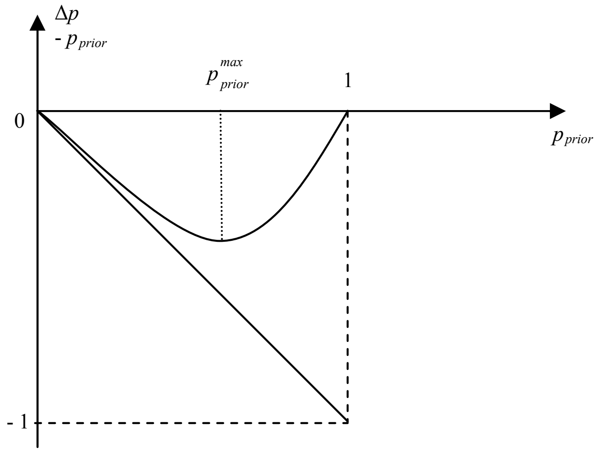
ΔD	Quarterly dividend change	p_{prior}	Investors' prior belief that ΔE is persistent
ΔE	Unexpected quarterly earnings change	$1 - p_{prior}$	Investors' prior belief that ΔE is transitory
ΔE_{pers}	Persistent unexpected earnings change	a	Probability that the firm announces a confirming dividend if ΔE is persistent
ΔE_{trans}	Transitory unexpected earnings change	b	Probability that the firm announces a confirming dividend if ΔE is transitory

Figure 2: Relationship between unexpected earnings change and dividend signal. Figure 2 reveals management's dividend policy. Management can send a confirming dividend change in either case. If the preceding earnings change is persistent (transitory), management will send a confirming dividend signal with probability *a* (*b*). We assume that, as company insider, management can quite accurately assess the persistence of the earnings change. Furthermore, we assume that the dividend change is a credible signal of earnings persistence. That is, management supports a persistent earnings change more with a confirming dividend signal, than a transitory earnings change ($a > b$).



p_{prior}	Investors' prior belief that the observed earnings change is persistent	Δp	Investors' reassessment of earnings persistence after receiving a confirming, imperfect dividend signal
p_{prior}^{max}	A-priori investor assessment of earnings persistence where a confirming, imperfect dividend signal evokes the strongest reassessment	$1 - p_{prior}$	Investors' reassessment of earnings persistence after receiving a confirming and perfectly revealing dividend signal

Figure 3: Maximum benefit $1 - p_{prior}$ in the case of a perfect dividend signal ($a > 0$, $b = 0$) and the benefit Δp of an imperfect signal ($a > 0$, $b > 0$). Figure 3 presents the benefit of a confirming dividend signal in updating investor assessment of earnings persistence. In general, when the dividend signal is not a perfectly revealing information signal, the relationship between the benefit of the updating dividend signal and the a-priori investor assessment is inverse u-shaped. Investors will then revise their a-priori assessment most strongly, if they believe a-priori in moderate earnings persistence. When the noise in the dividend signal is eliminated completely, the dividend signal reveals earnings persistence perfectly. Observing a confirming dividend signal is then equivalent to true earnings persistence. In this theoretical corner case, a monotonically decreasing relationship arises ($1 - p_{prior}$).



p_{prior}	Investors' prior belief that the observed earnings change is persistent	Δp	Investors' reassessment of earnings persistence after receiving a contradictory, imperfect dividend signal
p_{prior}^{max}	A-priori investor assessment of earnings persistence where a contradictory, imperfect dividend signal evokes the strongest reassessment	$1 - p_{prior}$	Investors' reassessment of earnings persistence after receiving a contradictory and perfectly revealing dividend signal

Figure 4: Maximum benefit ($- p_{prior}$) in the case of a perfect dividend signal and the benefit Δp of an imperfect signal. Figure 3 presents the benefit of a contradictory dividend signal in updating investor assessment of earnings persistence. In general, when the dividend signal is not a perfectly revealing information signal, the relationship between the benefit of the contradictory dividend signal and the a-priori investor assessment is u-shaped. Investors will revise their a-priori assessment most strongly, if they believe a-priori in moderate earnings persistence. When the noise in the dividend signal is eliminated completely, the dividend signal reveals earnings persistence perfectly. Observing a confirming dividend signal is then equivalent to true earnings persistence. In this theoretical corner case, a monotonically decreasing relationship arises ($- p_{prior}$).

Table 1: Definition of Variables

$CAR_{t,i}$	Firm *i*'s cumulative abnormal return around the dividend announcement at *t*, measured as the sum of five abnormal (size-adjusted) daily returns from two days prior to until two days after the dividend announcement.
$\Delta QEARN_{t,i}$	Firm *i*'s quarterly earnings change preceding the declared quarterly dividend change at *t*, measured as the difference between the current quarterly earnings announcement and the quarterly earnings announcement in the same quarter of the prior year. The variable is deflated by the market value at the start of the 5-day window used to calculate $CAR_{t,i}$, and quarterly earnings are defined as the quarterly net income before extraordinary items.
$\Delta QEARN^{2}_{t,i}$	Longer-term earnings change; in contrast to $\Delta QEARN_{t,i}$ it is the sum of the last two quarterly earnings changes preceding the quarterly dividend change. The variable is deflated by the market value at the start of the 5-day window used to calculate $CAR_{t,i}$.
$\Delta QEARN^{2,\mathrm{all}}_{t,i}$	Longer-term earnings change; in contrast to $\Delta QEARN_{t,i}$ it is the sum of the last two quarterly earnings changes preceding the quarterly dividend change. Additionally to $\Delta QEARN^{2}_{t,i}$, both preceding earnings changes have the same sign. The variable is deflated by the market value at the start of the 5-day window used to calculate $CAR_{t,i}$.
$\Delta FUTURE_{t,i}$	Variable capturing firm *i*'s future earnings growth after the dividend announcement at *t*, measured as the sum of the eight quarterly seasonal random walk earnings changes following the dividend change in quarter *t*. The variable is deflated by the market value at the start of the 5-day window used to calculate $CAR_{t,i}$.
$\Delta DIV_{t,i}$	The dividend change for firm *i* in quarter *t*, deflated by the market value at the start of the 5-day window used to calculate $CAR_{t,i}$.
$\%\Delta DIV_{t,i}$	The dividend change for firm *i* in quarter *t*, deflated by the previous quarterly dividend amount.
$\Delta DIV_{t,i}$ / $\Delta QEARN_{t,i}$	Relative size of the dividend change, defined as the ratio between the total dollar amount of the quarterly dividend change (scaled by market value) and the preceding quarterly earnings change (scaled by market value).
$LDUM_{t,i}$	Dummy variable set to 1 if firm *i* in quarter *t* belongs to the low persistence subsample, and 0 otherwise.
$MDUM_{t,i}$	Dummy variable set to 1 if firm *i* in quarter *t* belongs to the moderate persistence subsample, and 0 otherwise.
$HDUM_{t,i}$	Dummy variable set to 1 if firm *i* in quarter *t* belongs to the high persistence subsample, and 0 otherwise.
$TP^{\mathrm{lag1}}_{t,i}$	Earnings persistence parameter of the "Lag 1"-specification, earnings persistence is the estimated firm-specific slope coefficient of a regression of firm *i*'s earnings in quarter *t* on quarterly earnings of the same quarter in the preceding year, the earnings variable is defined as the quarterly net income before extraordinary items, deflated by yearly average total assets and we use a rolling window of ten years earnings information to estimate firm-specific, quarterly persistence parameters.
$TP^{\mathrm{lag2}}_{t,i}$	Earnings persistence parameter of the "Lag 2"-specification, earnings persistence is the estimated firm-specific slope coefficient of a regression of firm *i*'s earnings in quarter *t* on quarterly earnings of the same quarter two years back, the earnings variable is defined as the quarterly net income before extraordinary items, deflated by yearly average total assets and we use a rolling window of ten years earnings information to estimate firm-specific, quarterly persistence parameters.
$TP^{\mathrm{eps}}_{t,i}$	Earnings persistence parameter of the "Lag 1"-specification, earnings persistence is the estimated firm-specific slope coefficient of a regression of firm *i*'s earnings in quarter *t* on quarterly earnings of the same quarter in the preceding year, the earnings variable is defined as the quarterly earnings per share before extraordinary items (adjusted for stock splits) and we use a rolling window of ten years earnings information to estimate firm-specific, quarterly persistence parameters.

Table 2: Sample Criteria and Descriptive Statistics

Panel A: Sample Criteria

	Requirements	Number of observations
1)	At least two consecutive quarterly cash dividends (code number 1232 in CRSP), a change in these cash dividends, and the declaration date recorded for the dividend payments.	31,469
2)	Quarterly earnings information (net income before extraordinary items) for eight quarters prior to and eight quarters after the announcement of the dividend change, including the date of each quarterly earnings report.	19,574
3)	Requiring that dividend announcement dates occur on a business day, calculating announcement window abnormal returns and the market value two days prior to the dividend announcement, eliminating observations with no prior earnings change.	17,829
4)	Eliminating observations where the earnings change is reported within 10 days of the dividend declaration (unconditional sample).	12,501
5)	Requiring quarterly persistence parameters, estimated in a 10 year rolling regression with at least six observations in each regression (main, conditional sample).	8,635

Panel B: Distribution of Dividend Changes and Prior Earnings Changes[a]

Dividend Change	Confirmative	Contradictory	Total
Dividend Increase	6,033 (8,789)	2,004 (2,832)	8,037 (11,621)
Dividend Decrease	296 (438)	302 (442)	598 (880)
Total	6,329 (9,227)	2,306 (3,274)	8,635 (12,501)

Panel C: Summary Information on Key Variables for the Confirmative Sample[b]

Variable	Mean	Std. Dev.	10%	25%	Median	75%	90%
$CAR_{t,i}$	0.007	0.045	-0.038	-0.016	0.005	0.028	0.055
$\Delta QEARN_{t,i}$	0.006	0.043	0.000	0.002	0.003	0.007	0.015
$\Delta QEARN_{t,i}^{2}$	0.011	0.031	0.001	0.003	0.007	0.015	0.029
$\Delta QEARN_{t,i}^{2,\mathrm{all}}$	0.012	0.033	0.002	0.004	0.008	0.016	0.031
$\Delta FUTURE_{t,i}$	0.014	0.124	-0.040	-0.004	0.015	0.036	0.071
$\Delta DIV_{t,i} / \Delta QEARN_{t,i}$	0.624	3.972	0.028	0.067	0.157	0.353	0.827
$TP_{t,i}^{\mathrm{lag1}}$	0.359	0.419	-0.148	0.082	0.388	0.633	0.817
$TP_{t,i}^{\mathrm{lag2}}$	0.124	0.509	-0.363	-0.144	0.090	0.371	0.650
$TP_{t,i}^{\mathrm{eps}}$	0.598	0.515	-0.085	0.224	0.652	1.004	1.153

[a] Panel B contains the numbers of the unconditional (conditional) sample of 12,501 (8,635) observations.

[b] The variables are defined in Table 1.

Table 3: Results for the Conditional Effect on the Confirmatory Dividend Sample

Model (21) $CAR_{t,i} = \alpha + \alpha_L \cdot LDUM_{t,i} + \alpha_M \cdot MDUM_{t,i} + \beta_L \cdot \Delta QEARN_{t,i} \cdot LDUM_{t,i} + \beta_M \cdot \Delta QEARN_{t,i} \cdot MDUM_{t,i} + \beta_H \cdot \Delta QEARN_{t,i} \cdot HDUM_{t,i} + \gamma \cdot \Delta FUTURE_{t,i} + \varepsilon_{t,i}$

	α	α_L	α_M	β_L	β_M	β_H	γ	R^2	N
All	0.005 (5.20)	-0.002 (-1.56)	0.000 (0.01)	0.244 (3.77)	0.626 (5.64)	0.411 (6.69)	0.004 (0.92)	0.030	6,329
					$(\beta_M > \beta_L)^{***}, (\beta_M > \beta_H)^{**}, (\beta_H > \beta_L)^{**}$				
25% [a]	0.004 (3.27)	-0.001 (-0.77)	-0.001 (-0.73)	0.746 (3.22)	1.074 (5.05)	0.792 (3.81)	0.018 (1.49)	0.051	4,766
50% [a]	0.005 (2.67)	-0.005 (-2.02)	-0.002 (-1.03)	1.828 (4.89)	1.402 (4.14)	1.050 (1.91)	0.037 (2.13)	0.076	3,137
75% [a]	0.003 (1.16)	-0.005 (-1.48)	0.001 (0.29)	3.950 (4.02)	0.688 (0.89)	2.455 (2.66)	0.071 (2.83)	0.102	1,552
					$(\beta_L > \beta_M)^{***}, (\beta_H > \beta_M)^{*}$				

[a] We eliminate the weakest 25%, the weakest 50% and weakest 75% confirmative dividend changes from the unconditional sample, according to the absolute value of $\Delta DIV_{t,i}/\Delta QEARN_{t,i}$ and then run our conditional tests on these restricted samples.

Earnings persistence parameter α_1 is estimated with a one-year lag specification according to Model (19), the variables $\Delta QEARN_{t,i}$ and $\Delta FUTURE_{t,i}$ are winsorized at the 1- and 99-percentiles. The variables are defined in Table 1.
We use ordinary least squares with two-way clustered (clustered by firm and time) standard errors; t-statistics are in parentheses below the estimated coefficients.
The results for pairwise testing the statistical difference between β_L, β_M and β_H are indicated by
* one-tailed probability < 0.10, ** one-tailed probability < 0.05, *** one-tailed probability < 0.01.

Table 4: Results for the Conditional Effect on the Confirmatory Sample Using Alternative Definitions of Past Earnings Changes

Model (21) $CAR_{t,i} = \alpha + \alpha_L \cdot LDUM_{t,i} + \alpha_M \cdot MDUM_{t,i} + \beta_L \cdot \Delta QEARN^2_{t,i} \cdot LDUM_{t,i} + \beta_M \cdot \Delta QEARN^2_{t,i} \cdot MDUM_{t,i} + \beta_H \cdot \Delta QEARN^2_{t,i} \cdot HDUM_{t,i} + \gamma \cdot \Delta FUTURE_{t,i} + \varepsilon_{t,i}$

Panel A: $\Delta QEARN^2_{t,i}$ is the Sum of the Prior Two Quarters of Earnings Changes

	α	α_L	α_M	β_L	β_M	β_H	γ	R^2	N
All	0.004 (4.38)	-0.002 (-1.09)	-0.000 (-0.20)	0.161 (4.25)	0.350 (6.31)	0.160 (3.92)	0.005 (1.39)	0.028	6,367
					$(\beta_M > \beta_L)^{***}, (\beta_M > \beta_H)^{***}$				
25% [a]	0.005 (3.57)	-0.002 (-0.95)	-0.003 (-1.47)	0.315 (3.92)	0.479 (5.93)	0.152 (1.88)	0.020 (1.87)	0.038	4,879
					$(\beta_M > \beta_L)^{*}, (\beta_M > \beta_H)^{***}, (\beta_L > \beta_H)^{*}$				
50% [a]	0.006 (3.66)	-0.004 (-1.95)	-0.004 (-2.12)	0.422 (6.10)	0.464 (3.93)	0.098 (0.84)	0.030 (1.97)	0.037	3,366
					$(\beta_M > \beta_H)^{**}, (\beta_L > \beta_H)^{***}$				
75% [a]	0.003 (1.54)	-0.003 (-1.00)	-0.001 (-0.26)	0.411 (4.32)	0.243 (1.61)	0.227 (2.13)	0.037 (2.30)	0.025	1,884
					$(\beta_L > \beta_H)^{*}$				

Table 4 (Continued): Results for the Conditional Effect on the Confirmatory Sample Using Alternative Definitions of Past Earnings Changes

Model (21) $CAR_{t,i} = \alpha + \alpha_L \cdot LDUM_{t,i} + \alpha_M \cdot MDUM_{t,i} + \beta_L \cdot \Delta QEARN_{t,i}^{2,\text{all}} \cdot LDUM_{t,i} + \beta_M \cdot \Delta QEARN_{t,i}^{2,\text{all}} \cdot MDUM_{t,i} + \beta_H \cdot \Delta QEARN_{t,i}^{2,\text{all}} \cdot HDUM_{t,i} + \gamma \cdot \Delta FUTURE_{t,i} + \varepsilon_{t,i}$

Panel B: $\Delta QEARN_{t,i}^{2,\text{all}}$ is the Sum of the Prior Two Quarters of Earnings Changes, Both Quarters Have the Same Sign

	α	α_L	α_M	β_L	β_M	β_H	γ	R^2	N
All	0.005	-0.002	-0.002	0.155	0.359	0.147	0.013	0.032	5,183
	(4.74)	(-1.43)	(-1.22)	(3.72)	(5.93)	(3.25)	(1.45)		
				$(\beta_M > \beta_L)^{***}, (\beta_M > \beta_H)^{***}$					
25% [a]	0.006	-0.003	-0.005	0.316	0.498	0.132	0.023	0.042	3,918
	(3.95)	(-1.32)	(-2.32)	(3.34)	(5.37)	(1.44)	(1.59)		
				$(\beta_M > \beta_L)^{*}, (\beta_M > \beta_H)^{***}, (\beta_L > \beta_H)^{*}$					
50% [a]	0.006	-0.006	-0.006	0.511	0.572	0.058	0.039	0.045	2,575
	(3.45)	(-2.34)	(-2.32)	(5.18)	(3.43)	(0.40)	(1.91)		
				$(\beta_M > \beta_H)^{**}, (\beta_L > \beta_H)^{***}$					
75% [a]	0.003	-0.006	-0.002	0.935	0.361	0.234	0.063	0.037	1,223
	(1.41)	(-1.73)	(-0.45)	(3.62)	(1.46)	(1.52)	(2.57)		
				$(\beta_L > \beta_M)^{*}, (\beta_L > \beta_H)^{***}$					

[a] We eliminate the weakest 25%, the weakest 50% and weakest 75% confirmative dividend changes from the unconditional sample, according to the absolute value of $\Delta DIV_{t,i} / \Delta QEARN_{t,i}$ and then run our conditional tests on these restricted samples.

Earnings persistence parameter α_1 is estimated with a one-year lag specification according to Model (19), the variables $\Delta QEARN_{t,i}$, $\Delta QEARN_{t,i}^{2,\text{all}}$ and $\Delta FUTURE_{t,i}$ are winsorized at the 1- and 99-percentiles. The variables are defined in Table 1.

We use ordinary least squares with two-way clustered (clustered by firm and time) standard errors; t-statistics are in parentheses below the estimated coefficients. The results for pairwise testing the statistical difference between β_L, β_M and β_H are indicated by

* one-tailed probability < 0.10, ** one-tailed probability < 0.05, *** one-tailed probability < 0.01.

Table 5: Results for the Conditional Effect on the Confirmatory Sample Using Alternative Specifications for Past Time-Series Persistence

Model (21) $CAR_{t,i} = \alpha + \alpha_L \cdot LDUM_{t,i} + \alpha_M \cdot MDUM_{t,i} + \beta_L \cdot \Delta QEARN_{t,i} \cdot LDUM_{t,i} + \beta_M \cdot \Delta QEARN_{t,i} \cdot MDUM_{t,i} + \beta_H \cdot \Delta QEARN_{t,i} \cdot HDUM_{t,i} + \gamma \cdot \Delta FUTURE_{t,i} + \varepsilon_{t,i}$

Panel A: Past Time-Series Persistence is Measured by $TP_{t,i}^{\text{lag2}}$ [a]

	α	α_L	α_M	β_L	β_M	β_H	γ	R^2	N
All	0.005	-0.001	-0.002	0.286	0.671	0.264	0.004	0.027	6,179
	(5.21)	(-0.71)	(-1.57)	(3.70)	(5.82)	(4.51)	(1.09)		
					$(\beta_M > \beta_L)^{***}, (\beta_M > \beta_H)^{***}$				
25% [b]	0.004	-0.000	-0.003	0.635	1.417	0.756	0.015	0.054	4,649
	(2.89)	(-0.10)	(-1.61)	(3.20)	(6.03)	(3.26)	(1.22)		
					$(\beta_M > \beta_L)^{***}, (\beta_M > \beta_H)^{**}$				
50% [b]	0.004	-0.002	-0.004	1.401	2.639	0.833	0.034	0.082	3,062
	(2.50)	(-1.11)	(-1.82)	(4.58)	(5.40)	(1.92)	(1.94)		
					$(\beta_M > \beta_L)^{**}, (\beta_M > \beta_H)^{***}$				
75% [b]	0.003	-0.001	-0.005	2.066	4.236	1.885	0.056	0.087	1,516
	(1.24)	(-0.49)	(-1.60)	(2.13)	(4.43)	(2.25)	(2.57)		
					$(\beta_M > \beta_L)^{*}, (\beta_M > \beta_H)^{**}$				

Table 5 (Continued): Results for the Conditional Effect on the Confirmatory Sample Using Alternative Specifications for Past Time-Series Persistence

Model (21) $CAR_{t,i} = \alpha + \alpha_L \cdot LDUM_{t,i} + \alpha_M \cdot MDUM_{t,i} + \beta_L \cdot \Delta QEARN_{t,i} \cdot LDUM_{t,i} + \beta_M \cdot \Delta QEARN_{t,i} \cdot MDUM_{t,i} + \beta_H \cdot \Delta QEARN_{t,i} \cdot HDUM_{t,i} + \gamma \cdot \Delta FUTURE_{t,i} + \varepsilon_{t,i}$

Panel B: Past Time-Series Persistence is Measured by $TP^{eps}_{t,i}$ [a]

	α	α_L	α_M	β_L	β_M	β_H	γ	R^2	N
All	0.007	-0.004	-0.004	0.324	0.609	0.251	0.004	0.027	6,389
	(7.78)	(-2.38)	(-2.77)	(5.52)	(5.49)	(2.47)	(0.88)		
					$(\beta_M > \beta_L)^{**}, (\beta_M > \beta_H)^{**}$				
25% [b]	0.005	-0.002	-0.002	0.835	0.993	0.540	0.018	0.051	4,811
	(4.35)	(-1.25)	(-1.29)	(4.70)	(4.03)	(2.30)	(1.50)		
					$(\beta_M > \beta_H)^{*}$				
50% [b]	0.005	-0.004	-0.000	1.628	1.103	0.410	0.039	0.075	3,173
	(3.20)	(-1.82)	(-0.06)	(6.68)	(1.80)	(0.90)	(2.28)		
					$(\beta_L > \beta_H)^{***}$				
75% [b]	0.007	-0.008	-0.004	3.260	1.176	0.063	0.056	0.095	1,573
	(3.84)	(-2.98)	(-1.73)	(3.67)	(1.57)	(0.10)	(2.22)		
					$(\beta_L > \beta_M)^{**}, (\beta_L > \beta_H)^{***}$				

[a] Panel A reports the results when the earnings persistence parameter is estimated with a two-year lag specification, according to Model (20). Panel B reports the results when the earnings persistence parameter is estimated with a one-year lag specification, according to Model (19) where we use quarterly earnings per share before extraordinary items, adjusted for stock splits.

[b] We eliminate the weakest 25%, the weakest 50% and weakest 75% confirmative dividend changes from the unconditional sample according to the absolute value of $\Delta DIV_{t,i} / \Delta QEARN_{t,i}$ and then run our conditional tests on these restricted samples.

The variables $\Delta QEARN_{t,i}$ and $\Delta FUTURE_{t,i}$ are winsorized at the 1- and 99-percentiles. The variables are defined in Table 1.

We use ordinary least squares with two-way clustered (clustered by firm and time) standard errors; t-statistics are in parentheses below the estimated coefficients. The results for pairwise testing the statistical difference between β_L, β_M and β_H are indicated by

* one-tailed probability < 0.10, ** one-tailed probability < 0.05, *** one-tailed probability < 0.01.

Table 6: Results for the Conditional Effect on the Confirmatory Sample, Including Controls for Dividend Size

Model: $CAR_{t,i} = \alpha + \alpha_L \cdot LDUM_{t,i} + \alpha_M \cdot MDUM_{t,i} + \beta_L \cdot \Delta QEARN_{t,i} \cdot LDUM_{t,i} + \beta_M \cdot \Delta QEARN_{t,i} \cdot MDUM_{t,i} + \beta_H \cdot \Delta QEARN_{t,i} \cdot HDUM_{t,i} + \gamma_1 \cdot \Delta FUTURE_{t,i} + \gamma_2 \cdot \Delta DIV_{t,i} + \varepsilon_{t,i}$

Panel A: Dividend Size is Proxied by $\Delta DIV_{t,i}$ [a]

	α	α_L	α_M	β_L	β_M	β_H	γ_1	γ_2	R^2	N
All	0.004	-0.002	0.000	0.034	0.375	0.099	0.004	4.000	0.066	6,329
	(4.72)	(-1.28)	(0.06)	(0.51)	(3.76)	(1.26)	(1.14)	(6.07)		
					$(\beta_M > \beta_L)^{***}, (\beta_M > \beta_H)^{***}$					
25% [b]	0.004	-0.002	-0.002	0.150	0.488	0.122	0.017	3.703	0.081	4,766
	(3.34)	(-0.85)	(-0.91)	(0.59)	(2.04)	(0.46)	(1.40)	(4.46)		
50% [b]	0.005	-0.005	-0.003	0.679	0.428	-0.272	0.036	3.671	0.106	3,137
	(3.10)	(-2.30)	(-1.41)	(1.67)	(0.98)	(-0.42)	(2.08)	(3.59)		
					$(\beta_L > \beta_H)^{*}$					
75% [b]	0.003	-0.005	0.000	1.554	-1.099	0.141	0.065	3.514	0.131	1,552
	(1.38)	(-1.69)	(0.01)	(1.08)	(-1.04)	(0.11)	(2.63)	(2.37)		
					$(\beta_L > \beta_M)^{**}$					

Table 6 (Continued): Results for the Conditional Effect on the Confirmatory Sample, Including Controls for Dividend Size

Model: $CAR_{t,i} = \alpha + \alpha_L \cdot LDUM_{t,i} + \alpha_M \cdot MDUM_{t,i} + \beta_L \cdot \Delta QEARN_{t,i} \cdot LDUM_{t,i} + \beta_M \cdot \Delta QEARN_{t,i} \cdot MDUM_{t,i} + \beta_H \cdot \Delta QEARN_{t,i} \cdot HDUM_{t,i} + \gamma_1 \cdot \Delta FUTURE_{t,i} + \gamma_2 \cdot \%\Delta DIV_{t,i} + \varepsilon_{t,i}$

Panel B: Dividend Size is Proxied by $\%\Delta DIV_{t,i}$ [a]

	α	α_L	α_M	β_L	β_M	β_H	γ_1	γ_2	R^2	N
All	0.002	-0.002	0.000	0.141	0.497	0.240	0.001	0.030	0.052	6,329
	(1.82)	(-1.42)	(0.02)	(2.24)	(4.77)	(4.06)	(0.30)	(7.54)		
					$(\beta_M > \beta_L)^{***}, (\beta_M > \beta_H)^{**}$					
25% [b]	0.002	-0.002	-0.002	0.522	0.778	0.436	0.017	0.025	0.069	4,766
	(1.27)	(-0.90)	(-0.87)	(2.33)	(3.67)	(2.08)	(1.47)	(5.80)		
50% [b]	0.003	-0.005	-0.003	1.342	0.997	0.425	0.034	0.025	0.093	3,137
	(1.40)	(-2.13)	(-1.26)	(3.75)	(2.83)	(0.79)	(2.01)	(4.83)		
					$(\beta_L > \beta_H)^{*}$					
75% [b]	0.000	-0.005	0.000	3.039	0.099	1.409	0.067	0.023	0.118	1,552
	(0.05)	(-1.54)	(0.16)	(2.82)	(0.13)	(1.59)	(2.78)	(3.20)		
					$(\beta_L > \beta_M)^{**}, (\beta_L > \beta_H)^{*}$					

[a] Panel A reports the results when we control additionally for dividend size, by adding $\Delta DIV_{t,i}$ to the regression (21); Panel B reports the results when we control for dividend size, by adding $\%\Delta DIV_{t,i}$ to the regression (21).

[b] We eliminate the weakest 25%, the weakest 50% and weakest 75% confirmative dividend changes from the unconditional sample, according to the absolute value of $\Delta DIV_{t,i} / \Delta QEARN_{t,i}$ and then run our conditional tests on these restricted samples.

Earnings persistence parameter α_1 is estimated with a one-year lag specification according to Model (19), the variables $\Delta QEARN_{t,i}$, $\Delta FUTURE_{t,i}$, $\Delta DIV_{t,i}$, and $\%\Delta DIV_{t,i}$ are winsorized at the 1- and 99-percentiles. The variables are defined in Table 1.
We use ordinary least squares with two-way clustered (clustered by firm and time) standard errors; t-statistics are in parentheses below the estimated coefficients.
The results for pairwise testing the statistical difference between β_L, β_M and β_H are indicated by
* one-tailed probability < 0.10, ** one-tailed probability < 0.05, *** one-tailed probability < 0.01.

Table 7: Results for the Conditional Effect on the Contradictory Dividend Sample

Model (21) $CAR_{t,i} = \alpha + \alpha_L \cdot LDUM_{t,i} + \alpha_M \cdot MDUM_{t,i} + \beta_L \cdot \Delta QEARN_{t,i} \cdot LDUM_{t,i} + \beta_M \cdot \Delta QEARN_{t,i} \cdot MDUM_{t,i} + \beta_H \cdot \Delta QEARN_{t,i} \cdot HDUM_{t,i} + \gamma \cdot \Delta FUTURE_{t,i} + \varepsilon_{t,i}$

	α	α_L	α_M	β_L	β_M	β_H	γ	R^2	N
All	0.000 (0.28)	0.004 (1.82)	0.001 (0.34)	-0.057 (-0.92)	-0.367 (-2.44)	-0.079 (-0.92)	0.031 (3.31)	0.018	2,306
					$(\beta_L > \beta_M)^{**}, (\beta_H > \beta_M)^{**}$				
25% [a]	0.000 (0.04)	0.005 (1.78)	0.000 (0.07)	-0.537 (-3.69)	-0.897 (-1.88)	-0.903 (-3.02)	0.030 (1.19)	0.039	1,723
50% [a]	0.002 (0.65)	0.005 (1.68)	-0.002 (-0.45)	-0.360 (-0.84)	-3.127 (-2.68)	-2.392 (-3.09)	0.033 (1.03)	0.075	1,146
					$(\beta_L > \beta_M)^{**}, (\beta_L > \beta_H)^{**}$				
75% [a]	0.003 (0.96)	0.004 (0.83)	-0.001 (-0.14)	-1.680 (-1.81)	-8.610 (-4.16)	-3.224 (-2.32)	0.030 (0.70)	0.153	571
					$(\beta_L > \beta_M)^{***}, (\beta_H > \beta_M)^{**}$				

[a] We first eliminate the weakest 25%, the weakest 50% or weakest 75% contradictory dividend changes from the unconditional sample, according to the absolute value of $\Delta DIV_{t,i} / \Delta QEARN_{t,i}$ and then run our conditional tests on these restricted samples.

Earnings persistence parameter α_1 is estimated with a one-year lag specification, according to Model (19), the variables $\Delta QEARN_{t,i}$ and $\Delta FUTURE_{t,i}$ are winsorized at the 1- and 99-percentiles. The variables are defined in Table 1.

We use ordinary least squares with two-way clustered (clustered by firm and time) standard errors; t-statistics are in parentheses below the estimated coefficients. The results for pairwise testing the statistical difference between β_L, β_M and β_H are indicated by

* one-tailed probability < 0.10, ** one-tailed probability < 0.05, *** one-tailed probability < 0.01.