The Information Content of Dividends: Safer Profits, not Higher Profits*

Roni Michaely†, Stefano Rossi‡, and Michael Weber§

This version: August 2017

Abstract

Empirically, changes in profits do not follow changes in dividends, contrary to the central prediction of signaling models. We show both theoretically and empirically that dividends signal safer, rather than higher, future profits. We estimate expected cash flows from data on stock returns using the Campbell (1991) decomposition. Consistent with our model's predictions, cash-flow volatility changes in the opposite direction of dividend changes and larger changes in volatility come with larger announcement returns. We find similar results for share repurchases. Crucially, the data supports the prediction unique to our model that the cost of the signal is foregone investment opportunities. We conclude that payout policy conveys information about future cash flow volatility. Our methodology can be applied to overcome empirical problems in testing theories of corporate financing more generally.

JEL classification: G35

Keywords: Dividends, Payout Policy, Cash Flow Volatility, Signaling Model

*We thank Xavier Freixas, Nicola Gennaioli, Jose-Luis Peydro, Victoria Vanasco and seminar participants at Bocconi, Cambridge, London Business School, London School of Economics, Universitat Pompeu Fabra and University of Warwick for valuable comments. Weber acknowledges financial support by the Fama-Miller Center for Research in Finance at the University of Chicago Booth School of Business. We thank Xiao Yin and Lisa Li for valuable research assistance.

†Johnson@Cornell Tech, Cornell University, NY, USA. e-Mail: rm34@cornell.edu

‡Bocconi University, Milan, Italy; CEPR and ECGI. e-Mail: stefano.rossi@unibocconi.it.

§Booth School of Business, University of Chicago, Chicago, IL, USA and NBER. e-Mail: michael.weber@chicagobooth.edu.

I Introduction

Dividends represent one of the major financial decisions of corporations. Understanding how capital markets evaluate dividends and why firms pay dividends has bearings for theories of asset pricing, portfolio allocation, capital structure, capital budgeting, cost of capital, and also for public economics, in particular for the effects of tax policy. Yet, despite extensive research, financial economists still do not have a sufficient understanding why capital markets value dividends;[1] why some firms pay dividends and some others do not; and how firm's payout policies are determined. Even firms with very similar observable characteristics such as age, earnings, and level of cash display stark differences in terms of their dividend policies.

One appealing and intuitive idea, dating back at least to Miller and Modigliani (1961), holds that dividend changes convey information about firms' future prospects. This idea was later formalized by Miller and Rock (1985) and others,[2] suggesting that dividends signal future profits. Therefore, dividend changes should be followed by earnings or cash flow changes in the same direction. However, numerous empirical studies have failed to find evidence supporting this mechanism.[3] DeAngelo et al. (2009) summarize the empirical evidence as follows: "We conclude that managerial signaling motives [...] have at best minor influence on payout policy". We argue prior theoretical and empirical work pointed the light to the wrong direction, namely the literature examined whether dividend changes signal changes in the level of future cash flows.

We show both theoretically and empirically that dividends changes do signal, but they signal future cash flow volatility, not the level of future cash flows. If firms announce a dividend policy before current cash flows are realized, then firms are able to commit to a higher dividend, the lower their expected future cash flow volatility. Intuitively, there is a precautionary savings motive, which is more binding for riskier firms. With

[1]The empirical evidence shows that stock prices systematically increase at the announcement of dividend initiations or increases; and systematically decrease at the announcement of dividend omissions or decreases, see, e.g., Pettit (1972, 1977), Charest (1978), Asquith and Mullins Jr (1983), Brickley (1983), and Eades, Hess, and Kim (1985).

[2]See, e.g., Bhattacharya (1979, 1980), John and Williams (1985), and Bernheim (1991).

[3]See, among others, Watts (1973), Gonedes (1978), Penman (1983), DeAngelo, DeAngelo, and Skinner (1996), Benartzi, Michaely, and Thaler (1997), Grullon, Michaely, and Swaminathan (2002).

asymmetric information about future cash flow volatility, this mechanism is amplified. Signaling is costly because, with imperfect access to capital markets, paying dividends comes with foregone investment opportunities, and riskier firms find it too costly to mimic safer firms.

Our main prediction is that cash flow volatility should decrease following a dividend increase (or initiation), and should increase following a dividend decrease (or omission). Furthermore, larger dividend payments should carry more information, in the sense that larger dividend increases should be followed by both larger decreases in cash flow volatility and larger cumulative abnormal returns around the announcement.

Our model yields an additional, more nuanced cross-sectional prediction that speaks directly to the economic channel underlying our results. Because in our model the cost of the signal is foregone investment opportunities, following a dividend change we expect a larger change in future cash flow volatility, the *smaller* the firm's current earnings. The reason is that the smaller the current earnings, the larger the foregone future investment opportunities at a given level of dividend. As a result, the same dollar of dividend should carry a larger information content for lower level of earnings.

As a byproduct, our model helps us understand the survey evidence that managers increase dividends when they believe the chance for future cuts are lower, in the spirit of Lintner (1956) and Brav et al. (2005). If dividend increases signal safer profits going forward, then firms can afford to keep future dividend payments stable after the dividend increase. Furthermore, if there is a cost to stop paying dividends, then the risk of having to omit dividends is lower when earnings are more stable.

To test the model empirically, we need to estimate the volatility of cash flows. We face two challenges. First, realized cash flows are non-stationary, which implies that computing the standard deviation of realized earnings or cash flows will generate a biased estimate of cash flow volatility. Second, we need a precise estimate of the volatility of cash flows, as opposed to, say, the volatility of assets or returns. To address these challenges, we borrow a methodology from asset pricing. Namely, we use a methodology initially proposed by Campbell (1991), Campbell and Shiller (1988a), and Campbell and Shiller (1988b) to study aggregate market return predictability. They argue that unexpectedly high returns

come from positive news about either higher future cash flows or lower future discount rates. Vuolteenaho (2002) extends this framework and applies it at the individual firm level. We follow Vuolteenaho (2002) to construct measures of cash flow and discount rate news and we examine whether they vary around dividend events.[4]

To implement this methodology, we begin by identifying four "dividend events" at the firm level, namely, dividend increases and decreases (the intensive margin) and dividend initiations and omissions (the extensive margin). Then, for each one of such events we estimate two firm-level vector auto regressions (VARs), one for the 60 months before the event and another for the 60 months afterwards. These VARs separately identify cash-flow and discount-rate news, and we then test whether cash-flow and discount rate-news after the dividend event are different from those before the event.

We find that the variance of cash-flow news is significantly lower after dividend increases and initiations; and the variance of cash-flow news is significantly higher after dividend decreases and omissions. Consistent with our theory, larger changes in dividends are associated with larger changes in cash-flow volatility in the expected direction; and announcements of larger changes in dividends are associated with larger cumulative abnormal returns in the same direction.

Crucially, we find that the same dollar of dividend paid is followed by a larger reduction in cash-flow volatility for firms with smaller current earnings. This result is consistent with our theory in which dividends signal future cash-flow volatility, and in which the cost of the signal is foregone investment opportunities. It is inconsistent with an agency theory of dividends in which dividends themselves constitute "good news" because they come with lower private benefits of control.

What about the first moment of expected cash flows? We revisit the earlier evidence on changes in the first moment of earnings following changes in dividends using our methodology, and we confirm the earlier findings that in general corporate earnings do not change in the same direction as dividend changes, inconsistent with the traditional dividend signaling models. Furthermore, we find that discount-rate news do not change

[4]Note that other popular measures of volatility in asset pricing, such as for instance the implied volatility from option prices, measure the volatility of returns, so it is not clear to what extent they capture the volatility of cash flows or discount rates.

following dividend changes. Hence, any change in firm-level riskiness following dividend events relates exclusively to cash flow volatility.

Finally, we turn to examining share repurchases. Prior empirical literature has documented several differences between dividend and share repurchase policies, most notably, the existence of some substitution between them (e.g., Grullon and Michaely (2002)). In our simple framework, however, share repurchases are just yet another way to return cash to shareholders. As a result, we expect a pattern of changes in cash-flow volatility following share repurchases announcements similar to announcements of dividend increases and initiations. Consistent with our hypothesis, we find a strong decline in cash-flow volatility following share repurchase announcements (and no changes in either the first moment of cash-flow news or discount-rate news); and larger share repurchase programs are associated with larger reductions in cash flow volatility. Furthermore, again consistent with our hypothesis, we find that larger cumulative abnormal returns on the announcement of share repurchases are associated with larger subsequent declines in cash-flow volatility. We conclude that announcements of changes to firms' payout policy, be it through dividends or share repurchases, convey information about future changes in firms' cash-flow volatility.

Our empirical approach presents four advantages relative to prior literature. First, by using a stock return decomposition we directly measure variables that investors care about and that capital markets do price. By contrast, approaches based exclusively on accounting information may measure variables that are not value relevant and may thus be prone to criticism. Second, by using stock returns rather than realized earnings or cash flows, we are employing a framework that is not subject to the non-stationarity bias that arises when estimating cash flows from accounting information.[5] Third, our approach also delivers a measure of the first moment of expected future cash flows, thereby allowing us to revisit prior empirical literature on the first moment of cash flows with a method whose parameters are market-based estimates. Fourth, as yet another byproduct our approach also delivers a measure of expected discount rates, allowing us to test whether dividend

[5]A vast literature in accounting indicates that earnings changes have both permanent and transitory components, which implies a non-stationary distribution (e.g., see Brooks and Buckmaster (1976), Collins and Kothari (1989), Easton and Zmijewski (1989), Kormendi and Lipe (1987), Ou and Penman (1989)).

changes convey information about changes in the firm's discount rate.[6]

Our results carry two implications. First, unlike prior literature we find support for the idea that dividends signal firms' future prospects: the signal is about expected cash-flow volatility, that is, the second moment of future cash flows and not the first moment. Signaling models of dividends were popular in the 1980s but they fell out of favor (e.g., DeAngelo et al. (2009)) as the data did not support their central prediction: the first moment of earnings should change in the same direction of dividend changes. Our paper shows payout policy does convey information about cash-flow volatility in a manner consistent with signaling theory and inconsistent with a host of alternative explanations. Second, while the literature has documented dividends and share repurchases have different features, we document they share one important attribute, that is, they both signal future changes in expected cash-flow volatility. One criticism of dividend signaling theories (e.g., Allen and Michaely (2003)) is many signaling models were unable to account for the different features of dividend and share repurchases. We show with respect to future changes in cash-flow volatility, dividends and share repurchases convey similar information to the market.

II The Theoretical Framework

In this section we develop our testable hypotheses. We begin by showing in Section II*A.* a simple framework with symmetric information and a precautionary savings motive is sufficient to generate our main prediction that dividend payments should correlate negatively with subsequent changes in cash-flow volatility. Such a simple framework, however, cannot account for 1) cross-sectional variation in the response of cash-flow volatility changes to changes in dividends, and 2) the announcement return evidence we present. Therefore, in Section II*B.* we add asymmetric information about future cash-flow volatility, we solve the resulting signaling model in Section II*C.* and we then develop our testable hypotheses in Section II*D.*

[6]There is some evidence that systematic risk–i.e., beta–changes after dividend changes (see Grullon et al. (2002)), but the evidence in Grullon et al. (2002) does not tell us whether it is changes in the riskiness of cash flows or discount rates that drives their findings.

A. Basic Setting

Consider a manager running a firms on behalf of risk-neutral investors, which operates for three dates ($t = 0, 1, 2$) and two periods. At $t = 0$, the manager starts with some cash reserves, ω_0, and invests, $I_0 \leq \omega_0$. At $t = 1$, the manager receives an endowment, ω_1, and decides on whether to pay dividends D_1. After that, cash flows are realized, $Y_1 = f(I_o) + \nu$, where f is a production function with $f' > 0$, $f'' < 0$, and $f''' > 0$; the shock ν is distributed according to some function G, with expected value $\mathbb{E}(\nu)$ that we normalize to 0, and some known variance σ^2, with $\mid \nu \mid << Y$. We denote $\mathbb{E}[Y_1] = Y$.[7] After dividends are paid and cash flows are realized, the manager invests any remaining cash, $I_1 = \omega_1 + Y_1 - D_1 + (\omega_0 - I_0)$. At $t = 2$, the manager pays out the final cash flows $Y_2 = f(I_1) + \nu$.[8] The interest rate equals zero. Thus, the timeline is as follows:

Time 0: Firm gets endowment ω_0; wlog invests $I_0 = \omega_0$;

Time 1: Firm gets endowment ω_1; decides how much dividend D_1 to pay; after D_1 is paid, $Y_1 = f(I_0) + \nu$ is realized; after that, the firm invests $I_1 = \omega_1 + Y_1 - D_1$;

Time 2: $Y_2 = f(I_1) + \nu$ is realized; remaining cash is paid out; the world ends.

Throughout the analysis we assume the existence of some financial constraints. To illustrate our results in the starkest manner, we completely shut down the firm's access to financial markets, although our results just require that external financing is not perfectly costless. Similarly, we maintain managers cannot perfectly hedge the risk of the firm's future cash flows.[9]

In this setting, the manager chooses the dividend payment to maximize

$$\max_{D_1} \quad D_1 + \mathbb{E}[Y_2]$$

subject to

$$Y_2 = f(I_1) + \nu$$

$$D_1 \leq \omega_1$$

[7] We rule out extreme negative realizations to avoid that at $t = 2$ the firm goes bankrupt.

[8] All values I_0, I_1, Y_1, Y_2, D_1 can be thought as being *per share*, without loss of generality.

[9] With perfect financial risk management and hedging, a firm's earnings become fully informative about the firm's future prospects, thereby limiting any information content of dividend policy (see, e.g., DeMarzo and Duffie (1995)).

which implies, assuming for illustration that the second constraint is slack, $D_1 < \omega_1$,

$$\max_{D_1} \quad D_1 + f\left(\omega_1 + Y - D_1 - \frac{a}{2} \cdot \sigma^2\right)$$

where $\mathbb{E}[Y_2] = \mathbb{E}[f(I_1) + \nu] = f\left(\omega_1 + Y - D_1 - \frac{a}{2} \cdot \sigma^2\right)$ and a is the certainty equivalent coefficient in the sense of Arrow-Pratt. The F.O.C. is $1 - f'\left(\omega_1 + Y - D_1 - \frac{a}{2} \cdot \sigma^2\right) \geq 0$.
Prediction 1 (baseline). It is straightforward to see that

$$\frac{\partial \sigma^2}{\partial D_1} = -\frac{2}{a} < 0$$

Larger dividends should be associated with subsequent lower cash-flow volatility. Because managers pay dividends before the cash flows are realized, they take into account, in a certainty equivalence sense, that paying higher dividends will make it more likely to forgo future investment opportunities, the higher the (expected) volatility of future cash flows.

This stylized model already delivers the main hypothesis of our paper that dividend changes should be followed by changes in cash-flow volatility in the opposite direction. Of course, this model is too stylized along several dimensions. First, it cannot account for the evidence that dividend announcements result in positive announcement returns, as the information set of investors does not change after observing the dividend. Furthermore, it only delivers a time series, "before-after" prediction, with no cross sectional variation (e.g., in this basic setting, $\frac{\partial^2 \sigma^2}{\partial D_1 \partial Y_1}\Big|_{\widehat{D}_1} = 0$). More generally, one can think of several alternative ways through which dividend changes and changes in cash-flow volatility changes might be negatively correlated. For example, more mature firms might both pay a higher dividend and experience lower cash flow volatility going forward. To address these issues and sharpen our understanding of the economic mechanism, we add asymmetric information about future cash flow volatility to our basic setting in the next section. Our purpose is to account for the announcement returns evidence, as well as generate additional empirical predictions, which we will then take to the data.

B. A Signalling Model of Dividends

We introduce asymmetric information by assuming the manager learns σ^2 at $t = 1$ before paying dividends, while investors observe only D_1. As a result, at $t = 1$, there is asymmetric information about the variance of the firm's cash flows, σ^2, which is distributed according to some function Ξ over $[\sigma^2_{\min}, \sigma^2_{\max}]$. Prior to $t = 1$, the investors and the manager have symmetric information on σ^2 with $\mathbb{E}[\sigma^2] = \sigma^2_p$, i.e., the prior. Both the investors and the manager also know that $\mathbb{E}[\nu] = 0$. Therefore, while the manager knows the true σ^2, investors attempt to infer σ^2 from the dividend policy.

For signaling to have a scope, at least some investors need to have a shorter horizons than others. Consistent with the signaling literature (e.g., Miller and Rock (1985)), we assume that some investors are hit by an idiosyncratic liquidity shock at $t = 1$ and as a result must sell their shares. To be precise, we assume that a fraction k of these investors sell after dividends D_1 are paid and before cash flows Y_2 are realized, while the remaining fraction $(1 - k)$ will hold their shares until $t = 2$, at which time they will learn the realization of σ^2. Investors may trade shares continuously between $t = 0$ and $t = 2$.

We can summarize the information set of the two groups of investors with respect to endowment, investment, random shock and net dividends at the time of the announcement of D_1 as:

$$\begin{aligned} \left\{\omega_0, \omega_1, I_0, D_1, \mathbb{E}(\nu) = 0, Var(\nu) = \sigma^2\right\} &= \phi^h \\ \{\omega_0, \omega_1, I_0, D_1, \mathbb{E}(\nu) = 0\} &= \phi^s, \end{aligned}$$

where ϕ^h is the information set of the investors who continue holding their shares, whereas ϕ^s is the information set of those who decide to sell. The perceived value of the firm at time 1 by those who decide to sell is thus

$$\begin{aligned} V_1^s &= D_1 + \mathbb{E}[Y_2 \mid \phi^s] \\ &= D_1 + \mathbb{E}[f(I_1) + \nu \mid \phi^s] = D_1 + \mathbb{E}[f(I_1) \mid \phi^s] \\ &= D_1 + \mathbb{E}[f(\omega_1 + Y_1 - D_1) \mid \phi^s]) \end{aligned}$$

Similarly, the perceived value of the firm at time 1 by those who decide to hold, is

$$\begin{aligned} V_1^h &= D_1 + \mathbb{E}\left[Y_2 \mid \phi^h\right] \\ &= D_1 + \mathbb{E}\left[f(\omega_1 + Y_1 - D_1) \mid \phi^h\right]. \end{aligned}$$

The manager acts in the interest of investors who own the firm at $t = 1$ and maximizes

$$\begin{aligned} \max_{\{D_1\}} \quad & W_1 = kV_1^s + (1-k)V_1^h \\ & \text{subject to} \\ & Y_2 = f(I_1) + \nu \\ & D_1 \leq \omega_1, \end{aligned}$$

where we assume ω_1 is sufficiently large and investors know that the investment at time 1 will be $I_1 = \omega_1 + Y_1 - D_1$ after the realization of Y_1.

In the Appendix, we show the concavity of the production function guarantees the single-crossing property of signaling games is satisfied. More generally, we show this problem satisfies the Riley (1979) conditions for games of incomplete information.

C. Solving the Model

Assume we can associate to each level of variance σ^2 a level of dividends D_1 that solves the optimization problem of the manager. We write this correspondence as $\sigma^2(D_1)$. If $\sigma^2(D_1)$ is single-valued and if the market is rational, we get the following condition

$$V^s(D_1) = V^h(\sigma^2(D_1), D_1) = V^h(\sigma^2, D_1).$$

Then we obtain

$$\begin{aligned} V^s(-\sigma^2(D_1), D_1) &= D_1 + f(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2(D_1)) \\ V^h(-\sigma^2, D_1) &= D_1 + f(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2). \end{aligned}$$

Valuation schedules that satisfy the conditions above and solve the maximization problem of the manager are termed "informationally consistent price functions" (Riley (1979)).

To find the Pareto dominant schedule, we start from the boundary condition that the worst firm which has the highest variance, i.e., σ^2_{max}, will choose the same optimal dividend D_1 as it would in the full-information case, so that

$$\begin{aligned} 1 - f'(\omega_1 + Y - \frac{a}{2}\sigma^2 - D_1^\star) &= 0 \\ \sigma^2(D_1^\star) &= \sigma^2_{max}. \end{aligned}$$

Since $V^s(D_1) = V^h(\sigma^2(D_1), D_1) = V^h(\sigma^2, D_1)$, the first order condition (FOC) is

$$kV^h_{-\sigma^2}(-\sigma^2(D_1), D_1)\frac{\partial(-\sigma^2)}{\partial D_1} + kV^h_d(-\sigma^2(D_1), D_1) + (1-k)V^h_d(-\sigma^2, D_1) = 0.$$

Given $\sigma^2(D_1) = \sigma^2$, the FOC is equivalent to the condition

$$kV^h_{-\sigma^2}(-\sigma^2(D_1), D_1)\frac{\partial(-\sigma^2)}{\partial D_1} + V^h_d(-\sigma^2, D_1) = 0,$$

i.e.,

$$1 - f'(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2) - \frac{ka}{2} \cdot f'(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2(D_1)) \cdot \frac{\partial \sigma^2(D_1)}{\partial D_1} = 0$$

Then, the ordinary differential equation (ODE) together with the boundary condition above uniquely determine the schedule. Relative to the first best case with full information, the signaling equilibrium features excessive dividend payment and under-investment. We picture the solution in Figure 1.

We can establish the relevant solution informally by checking the second order conditions for a maximum of the optimization problem of the manager,

$$\frac{\partial}{\partial D_1}\left[kV^h_{-\sigma^2}(-\sigma^2(D_1), D_1)\frac{\partial(-\sigma^2)}{\partial D_1} + kV^h_d(-\sigma^2(D_1), D_1) + (1-k)V^h_d(-\sigma^2, D_1)\right] < 0$$

Substituting the FOC, it leads to a simple condition guaranteeing a maximum

$$-V^h_{d\sigma^2}(\sigma^2, D)\frac{\partial \sigma^2}{\partial D_1} < 0$$

Since $V^h_{d\sigma^2}(\sigma^2, D) = \frac{a}{2}f''(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2) < 0$, a maximum occurs if and only if $\frac{\partial \sigma^2}{\partial D_1} < 0$. The relevant solution must lie on the right-hand side of the red line in Figure 1 where higher dividends are associated with a lower variance of cash flow. Thus, only dividends that exceed $D_1^\star$ are optimal. This is the Riley equilibrium outcome. In the Appendix, we show this equilibrium is the unique separating equilibrium of our game by applying the results of Mailath (1987), and we show it is the unique equilibrium that survives standard refinement concepts for this class of games (Esö and Schummer (2009); see also Ramey (1996) and Cho and Sobel (1990)).

In this model, dividends are a signal to the market about the volatility of cash flows. Because managers care about short-term institutional investors, they would like to signal that their cash flows have low volatility and therefore higher value. For this signal to be credible and thus generate a separating equilibrium, it must be costly. To prevent imitation, the signal as to be costlier for low types than for high types. This follows from the concavity of the production function, as riskier firms have more to lose in terms of foregone investment if they pay a larger dividend in an attempt to mimic safer firms.

D. Comparative Statics and Testable Implications

We derive the main comparative statics, which will guide our empirical analysis in the next section. The first comparative statics says dividend changes should be followed by changes in future cash flow volatility in the opposite direction.

Prediction 1 (signaling). Changes in dividends should be followed by changes in future cash flow volatility in the opposite direction, i.e. $\frac{\partial \sigma^2(D_1)}{\partial D_1} < 0$

As in the basic setting, paying higher dividends will make it more likely to have to forgo future investment opportunities, the higher the (expected) volatility of future cash flows. Asymmetric information amplifies this channel, because safer firms will be better able to afford to pay higher dividends.

The second comparative statics provides the more nuanced cross-sectional prediction of our model.

Prediction 2 (signaling). Following a dividend increase (re. decrease), there's a larger decrease (re. increase) in cash-flow volatility for firms with smaller (re. larger) current earnings,

$$\frac{\partial^2 \sigma^2 (D_1)}{\partial D_1 \partial Y_1} = -\frac{2f''(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2(D_1)}{k \cdot a \cdot \left[f'(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2(D_1)\right]^2} > 0$$

Prediction 2 states the cross derivative of cash-flow volatility with respect to dividends and (current) earnings is positive. The intuition is that, the smaller the current earnings, the larger are the foregone investment opportunities for a given level of dividend payment. Therefore, the same dividend should carry a larger information content for future changes in cash-flow volatility, the smaller the current earnings. This prediction depends crucially on asymmetric information about future cash flow volatility and does not obtain in the basic setting with symmetric information of Section II*A*.

Our next predictions relate to the effect of dividend announcements on firm value. In a fully separating equilibrium, investors perfectly learn the firm's type, σ^2, from the dividend announcement. Then, recalling that σ_p^2 indicates the prior belief about cash flow volatility, we obtain the change in firm value upon the dividend announcement, ΔV, as follows:

$$\Delta V = D_1 - \mathbb{E}[D_1] + \mathbb{E}[U(Y_2|D_1)] - \mathbb{E}[U(Y_2)] - \frac{a}{2}\left(\sigma^2 - \sigma_p^2\right),$$

where $\mathbb{E}[D_1]$ indicates the prior expectation of dividends and $\mathbb{E}[U(Y_2|D_1)]$ indicates the posterior expectation of the value of future cash flow upon observing dividend D_1. As in the dividend signaling literature, $\frac{\Delta V}{\Delta D_1} > 0$, reflecting the fact larger dividend announcements represent news about better future prospects. Contrary to the extant literature, in our framework, better future firm prospects refer not to the first but to the second moment of future cash flows. This leads us to an additional testable prediction.

Prediction 3. Denote with $\Delta\sigma^2 = \left(\sigma^2 - \sigma_p^2\right)$ the change in (expected) future cash flow volatility. Also, denote with $\Delta D = D_1 - \mathbb{E}[D_1]$ the (unexpected) change in dividends.

Then we have:

$$\frac{\Delta V}{\Delta \sigma^2} = -\frac{a}{2} < 0, \frac{\Delta V}{\Delta D} = 1 > 0,$$

that is, larger dividend announcement returns should be associated with larger dividend changes and larger subsequent reductions in cash-flow volatility.

Prediction 3 implies announcements of dividend changes should carry a larger information content (i.e., have a larger announcement return), the larger the expected reduction in future cash-flow volatility. Note also Prediction 3 does not obtain in the basic setting of Section II*A*., because that setting was based on fully symmetric information.

In our framework dividends and share repurchases are two equivalent ways to return cash to shareholders. As a result, Predictions 1 and 3 should also apply to share repurchases.[10]

III Method

To test our hypotheses on changes in cash flow volatility following dividend changes we require a measure of cash flow volatility. We borrow a methodology from asset pricing to estimate the first and second moment of expected future cash flows and discount rates, and we show how we can apply this method to test our hypotheses and, more generally, to overcome empirical problems in testing theories of corporate financing.

To see the intuition underlying the method, consider a simple discounted cash flow model, with expected future cash flows in the numerator and expected future discount rates in the denominator. In this framework, returns today can be unexpectedly high due to either positive news about current or future cash flows – the numerator – or due to negative discount-rate news – the denominator. This method allows us to 1) test our hypotheses on changes in expected cash-flow volatility (proxied by the second moment of cash-flow news) following dividend changes; 2) revisit the prior literature on earnings changes (proxied by the first moment of cash-flow news) following dividend changes; and 3) examine whether discount rates (proxied by discount-rate news) change following

[10]Note Prediction 2, which is about percent changes in cash payouts, is not defined for dividend initiations and for share repurchases, as in those cases the beginning-of-period level of cash returned to shareholders is zero.

dividend changes.

A large literature in economics and finance employs this VAR methodology developed in Campbell (1991) to decompose returns into news originating from cash flows and discount rates. Bernanke and Kuttner (2005) find cash-flow news are as important as discount-rates news for stock returns to monetary policy shocks following FOMC announcements. Vuolteenaho (2002) extends the VAR methodology to the individual firm level and finds cash-flow news are the main driver of stock returns at the firm level.[11]

The method provides a precise empirical counterpart to our theoretical predictions about *cash flow* volatility. By contrast, other measures of volatility (e.g., implied volatility from option prices) do not allow a decomposition into components originating from cash flows or discount rates. Furthermore, the method is immune to the bias that arises from non-stationarity when estimating cash flows from accounting information.[12] In fact, because corporate earnings are not stationary, measuring cash-flow volatility using the realized variance of earnings would pick up such non-stationarity rather than any information content of dividends. A large accounting literature has implicitly recognized this non-stationarity and has adopted a variety of adjustments for linear or non-linear trends in corporate earnings.[13] The observation earnings are non-stationary is akin to the observation by Fama (1965) and others stock prices are non-stationary, which prompted the field of asset pricing to focus on stock returns, i.e., stock price changes, rather than levels of stock prices.

A. Stock Return Decomposition

We employ the framework Vuolteenaho (2002) lays out to decompose stock returns into estimates of cash-flow and discount-rate news before and after dividend announcements. Because this method has so far not been applied in a corporate finance context, we first

[11] Cash-flow news are almost uncorrelated across firms which explains why discount-rate news are a main driver for stock returns of broad indices (see Campbell (1991) and Cochrane (1992, 2008)).

[12] We use the terms earnings and cash flows interchangeably for much of this paper. In robustness tests, we attempt to weed out the discretionary component of earnings to focus on cash flows, consistent with theoretical predictions.

[13] See, e.g., DeAngelo, DeAngelo, and Skinner (1996) and Grullon, Michaely, and Swaminathan (2002). However, no consensus exists on which adjustment is more appropriate (see, e.g., DeAngelo et al. (2009)).

review the basic ingredients and closely follow the original notation.

Vuolteenaho (2002) takes the dividend-discount model of Campbell and Shiller (1988a) for the aggregate market return as starting point and applies it to the individual firm. He adapts the present-value formula to accounting data, because many individual firms do not pay dividends. Three main assumptions are necessary to achieve this goal. First, the clean surplus identity holds, that is, earnings (X) equal the change in the book-value of equity (ΔB_t) minus dividends (D). Second, the book value of equity, dividends, and the market value of equity (M) are strictly positive. Third, log book and market equity and log dividends and log book equity are cointegrated.[14]

These assumptions allow us to write the log book-to-market ratio, θ as

$$\theta_{t-1} = k_{t-1} + \sum_{s=0}^{\infty} \rho^s r_{t+s} = \sum_{s=0}^{\infty} \rho^s (roe_{t+s} - f_{t+s}), \tag{1}$$

roe is log return on equity which we define as $roe_t = \log(1 + X_t/B_{t-1})$, r_t denotes the excess log stock return, $r_t = \log(1 + R_t + F_t) - f_t$, R_t is the simple excess return, F_t is the interest rate, f_t is log of 1 plus the interest rate, k summarizes linearizion constants which are not essential for the analysis, and ρ is a discount factor. The book-to-market ratio can be low, because market participants expect low future discount rates, that is, they discount a given stream of cash flow at a low rate (first component on the right-hand side of equation (1)), or because they expect high future cash flows (second component on the right-hand side of equation (1)).

We can follow Campbell (1991) to get return news from changes in expectations from $t-1$ to t and reorganizing equation (1)

$$r_t - \mathbb{E}_{t-1} r_t = \Delta \mathbb{E}_t \sum_{s=0}^{\infty} \rho^s (roe_{t+s} - f_{t+s}) - \Delta \mathbb{E}_t \sum_{s=1}^{\infty} \rho^s r_{t+s}. \tag{2}$$

$\Delta \mathbb{E}_t$ denotes the change in the expectations operator from $t-1$ to t, that is, $\mathbb{E}_t(\cdot) - \mathbb{E}_{t-1}(\cdot)$. Therefore, returns can be high, if we have news about higher current and future cash flows or lower future excess returns.

[14] We use small letters to denote the log of a variable unless specified otherwise.

Let's introduce some notation and write unexpected returns as the difference in cash-flow news, $\eta_{cf,t}$, and discount-rate news, $\eta_{r,t}$

$$r_t - \mathbb{E}_{t-1} r_t = \eta_{cf,t} - \eta_{r,t}. \tag{3}$$

B. Vector Autoregression

A VAR provides a simple time series model to infer long-horizon properties of returns from a short-run model and to implement the return decomposition. Let $z_{i,t}$ be a vector at time t containing firm-specific state variables. Let's assume a first-order VAR describes the evolution of the state variables well.[15] We can then write the system as

$$z_{i,t} = \Gamma z_{i,t-1} + u_{i,t}. \tag{4}$$

Σ denotes the variance-covariance matrix of u_{t+1} and we assume it is independent of the information set at time $t-1$.

Let's assume the state vector z contains firm returns as first component and let's define the vector $\boldsymbol{e1'} = [1\ 0\ \ldots\ 0]$. We can now write unexpected stock returns as

$$r_{i,t} - \mathbb{E}_{t-1} r_{i,t} = \boldsymbol{e1'} u_{i,t}. \tag{5}$$

Discount-rate news is

$$\eta_{r,t} = \Delta\, \mathbb{E}_t \sum_{s=1}^{\infty} \rho^s r_{t+s}, \tag{6}$$

[15] The assumption of a first-order VAR is not restrictive, because we can add lags of the state variables and adjust the notation accordingly.

which we can now simply write as

$$\eta_{r,t} = \boldsymbol{e1'} \sum_{s=1}^{\infty} \rho^s \Gamma^s u_{i,t+s} \tag{7}$$

$$= \boldsymbol{e1'} \rho\Gamma(\mathbb{1} - \rho\Gamma)^{-1} u_{i,t} \tag{8}$$

$$= \lambda' u_{i,t}, \tag{9}$$

where $\mathbb{1}$ is an identity matrix of suitable dimension and the last line defines notation.

It now follows we can write cash-flow news as

$$\eta_{cf,t} = (\boldsymbol{e1'} + \lambda') u_{i,t}. \tag{10}$$

and the variance of cash-flows as

$$\text{var}(\eta_{cf,t}) = (\boldsymbol{e1'} + \lambda') \Sigma (\boldsymbol{e1} + \lambda). \tag{11}$$

Armed with the above quantities, we now turn to our data on the intensive margin (increases and decreases) and extensive margin (initiations and omissions) of dividends.

IV Data

We use balance sheet data from the quarterly Compustat file and stock return data from the monthly CRSP file. We follow Grullon, Michaely, and Swaminathan (2002) and Michaely, Thaler, and Womack (1995) in defining quarterly dividend changes and dividend omissions and initiations and Vuolteenaho (2002) in the sample and variable construction of the state variables of the VAR we defined in Section III. We detail both below. The sample period is 1963 to 2015.

A. Cash Flow and Return News: Sample Screens

We follow Vuolteenaho (2002) and impose the following data screens. A firm must have quarter $t-1$, $t-2$, and $t-3$ book equity, $t-1$ and $t-2$ net income and long-term

debt data. Market equity must be available for quarters $t-1$, $t-2$, and $t-3$. A valid trade exists during the month immediately preceding quarter t return. A firm has at least one monthly return observation during each of the preceding five years. We exclude firms with quarter $t-1$ market equity less than USD 10 million and book-to-market ratio of more than 100 or less than 1/100.

B. Cash Flow and Return News: Variable Definitions

The simple stock return is the 3-month cumulative monthly return, recorded from m to $m+2$ for $m \in \{Feb, May, Aug, Nov\}$. If no return data are available, we substitute zeros for both returns and dividends. We follow Shumway (1997) and assume a delisting return of -30% if a firm is delisted for cause and has a missing delisting return. Market equity is the total market equity at the firm level from CRSP at the end of each quarter. If quarter t market equity is missing, we compound the lagged market equity with returns without dividends.

Book equity is shareholders' equity, plus balance sheet deferred taxes and investment tax credit (item TXDITCQ) if available, minus the book value of preferred stock. Depending on availability, we use stockholders' equity (item SEQQ), or common equity (item CEQQ) plus the carrying value of preferred stock (item PSTKQ), or total assets (item ATQ) minus total liabilities (item LTQ) in that order as shareholders' equity. We use redemption value (item PSTKRQ) if available, or carrying value for the book value of preferred stock. If book equity is unavailable, we proxy it by the last period's book equity plus earnings, less dividends. If neither earnings nor book equity is available, we assume the book-to-market ratio has not changed and compute the book equity proxy from the last period's book-to-market and this period's market equity. We set negative or zero book equity values to missing.

GAAP ROE is the earnings over the last period's book equity, measured according to the U.S. Generally Accepted Accounting Principles. We use earnings available for common equity, in the ROE formula. When earnings are missing, we use the clean-surplus formula to compute a proxy for earnings. In either case, we do not allow the firm to lose more than its book equity. Hence, the minimum GAAP ROE is truncated to -100%. We calculate

leverage as book equity over the sum of book equity and book debt. Book debt is the sum of debt in current liabilities, total long-term debt, and preferred stock.

Each quarter, we log transform market equity, stock returns, and return on equity and cross-sectionally demean it. A log transformation may cause problems if returns are close to -1 or if book-to-market ratios are close to zero or infinity. We mitigate these concerns by redefining a firm as a portfolio of 90 percent common stock and 10 percent Treasury bills using market values. Every period, the portfolio is rebalanced to these weights.

C. Dividend Changes

We use the CRSP daily file to identify dividend changes and follow Grullon, Michaely, and Swaminathan (2002) in the sample screens and to construct quarterly dividends changes. We use all dividend changes for common stocks of U.S. firms listed on NYSE, Amex, and Nasdaq which satisfy the following criteria. The distribution is a quarterly taxable cash dividend and the previous cash dividend payment was within a window of 20–90 trading days prior to the current dividend announcement. We focus on dividend changes between 12.5% and 500%. The lower bound ensures we include only economically meaningful dividend changes, and the upper bound eliminates outliers. We also ensure no other non-dividend distribution events such as stock splits, stock dividends, mergers, and so on, occurs within 15 trading days surrounding the dividend announcement. We end up with 2,441 dividend increases and 2,461 dividend decreases over 1963-2015.

D. Initiations and Omissions

We follow Michaely, Thaler, and Womack (1995) to construct our dividend initiation and omission sample. We require the following criteria for initiations to be in our sample. We focus on common stocks of U.S. companies which have been traded on the NYSE or AMEX for two years prior to the initiation of the first cash dividend. This screen eliminates new listings of firms which had previously traded on NASDAQ or on another exchange and switched the exchange with the pre-announced intention of paying dividends

in the near future. We end up with 552 dividend initiations over 1963-2015.

For omissions, the sample must meet one of the following three criteria: i) the company declared at least six consecutive quarterly cash payments and then paid no cash payment in a calendar quarter; ii) the company declared at least three consecutive semi-annual cash payments and then paid no cash payments in the next six months; iii) the company declared at least two consecutive annual cash payments and then paid no cash payments in the next year. We first identify potential omission quarters using the three conditions. We then use the Wall Street Journal (WSJ) Index to extract all information about dividend omissions. We enrich the WSJ Index data with searches on Factiva and ProQuest for any additional information regarding dividend omissions. We end up with 1,233 dividend omissions over 1963-2015.

E. Share Repurchases

We use Thomson ONE to construct our share repurchases sample. We use all repurchases of common stock announcemed between 1980 and 2015 for which we can determine the amount announced. Our procedure follows Jagannathan, Stephens, and Weisbach (2000) but they also study repurchases of preferred stock, which is not relevant for our purpose of studying payout policy to common stockholders; and Grullon and Michaely (2002) who use the Compustat definition of share repurchases and report a correlation of 0.97 between the Compustat and the SDC measures of share repurchases.

We end up with 2,662 share repurchases announcements over 1963-2015. Table 1 reports descriptive statistics for our sample.[16]

We ensure across specifications that we have non-overlapping data for the two VARs before and after dividend events and share repurchases, that is, two events at the firm level are at least 10 years apart.

[16]Despite imposing both the dividend sample screens above and the VAR restrictions of Section III, our sample sizes are comparable to those in prior studies on dividend changes (e.g., see Grullon et al. (2002)), dividend omissions (e.g., Michaely et al. (1995)), and share repurchases (e.g., Grullon and Michaely (2004)). One exception is dividend initiations, in which imposing the stringent VAR restrictions result in a smaller sample size than in prior literature. Relaxing these restrictions does not affect our results (see Table 4 Panel C).

V Results

In this section we report our empirical results. In Section V*A.*, we report the estimates of the VAR and the VAR implied importance of cash-flow news and expected return news for our sample of firms using the method we detail in Section III which closely follows Vuolteenaho (2002). In Section V*B.*, we report our univariate tests of Prediction 1. In Section V*C.*, we present tests of the more nuanced predictions of our mechanism, including Prediction 2. In Section V*D.*, we examine cumulative abnormal returns to the announcements of dividend events and we present tests of our Predictions 3 and 4. In Section V*E.*, we examine share repurchases.

A. Estimates of the VAR System

Following our discussion in Section III, a central ingredient for our analysis is an estimate of the transition matrix Γ of the VAR system and the discount factor ρ. We follow Vuolteenaho (2002) and estimate ρ as the regression coefficient of the excess log ROE minus the excess log stock return, plus the lagged book-to-market ratio on the book-to-market ratio. We find an estimate of 0.986 which is almost identical to the estimate of Vuolteenaho (2002).

Table 2 reports point estimates of a constant VAR across firms and time with t-stats in parenthesis. Consistent with findings in the literature, we find returns are positively autocorrelated, load positively on the log book-to-market ratio, and log profitability. The quarterly book-to-market ratio is highly autocorrelated and loads positively on lagged returns, and negatively on lagged profitability. Profitability is autocorrelated at the quarterly frequency, loads positively on lagged returns, and negatively on the lagged bool-to-market ratio. The dynamics of our state variables are broadly consistent with findings in the literature and especially Vuolteenaho (2002).

B. Dividend Events and Cash-flow Variance

We estimate a VAR before and after each dividend event-quarter using all available firm observations with non-missing balance-sheet data but requiring at least 5 years of data.

We then use equation (11) to calculate the cash-flow variance and compare the variability of cash flows after dividend events relative to before. According to our Prediction 1 in Section II, we expect announcements of dividend increases and dividend initiations to result in lower cash-flow volatility after the announcement relative to before and higher cash-flow volatilities for announcements of dividend cuts and dividend omissions. To ensure overlapping dividend events do not drive our results, we randomly drop one of the two events.[17]

Table 3 reports changes in cash-flow news and discount-rate news after dividend events relative to before separately for dividend increases, decreases, initiations, and omissions. We estimate for each dividend event two VARs before and after the quarter of the event using all firm observation with non-missing data. We then create cash-flow and discount rate news, winsorize the data at the 1% and 99% level, and report the average changes across events in the table.

We begin by revisiting with our novel method the earlier literature examining changes in the first moment of earnings following dividend changes. In Panel A, we find positive dividend changes, dividend initiations, negative dividend changes or dividend omissions or pooling across events do not result in a statistically significant change in cash-flow news after the event relative to before. These findings are consistent with the earlier literature which does not detect any predictive power of dividend events for the first moment of future realized earnings.

In Panel B, we also find that dividend events are not followed by changes in discount rates. These results indicate the positive announcement returns to increases in dividends or dividend initiations are unlikely driven by market expectations of lower future discount rates.[18]

We then turn to testing our main hypothesis. Consistent with our hypothesis we find in Panel C dividend increases are followed by a decrease in the variance of cash-flow news in the five years after the event relative to the variance of cash-flow news in the five years before. Similarly, for dividend decreases, we see an increase in the variability of cash-flow

[17]Results are robust to which event we drop and to not dropping any event.

[18]Therefore, this result indicates that the evidence in Grullon et al. (2002) of a decrease in systematic risk following dividend changes is not driven by changes in the riskiness of discount rates.

news after the event relative to before. Changes in dividends are followed by changes in cash flow volatility in the opposite direction, consistent with Prediction 1 in Section II.

The numbers in Panel C are difficult to interpret. We therefore scale the changes in cash-flow news variance around the dividend events by the average variance in cash-flow news before the event in Panel D. We see the variance of cash-flow news drops by on average 15% of the average variance before the event after announcements of dividend increases (see column (1)) but increases by more than 7% after dividend cuts (see column (4)). Dividend initiations result in a variance of cash-flow news which is on average 5% lower than the average variance before the dividend event but is not statistically significant which could be due to low power. Dividend omission lead to an increase in the cash-flow variance of similar magnitude but the difference is statistically significant (see columns (2) and (5)).

Vuolteenaho (2002) argues large amounts of data are necessary to get precise estimates of the transition matrix Γ of the VAR. So far, we use separate estimates for the transition matrix to get residuals for the five years before and after each dividend event. In Table 4, we impose more stringent restrictions on Γ trading off efficiency with precision. At the same time, we use a limited sample, because we impose the same restrictions as Vuolteenaho (2002), Grullon et al. (2002), Michaely et al. (1995). We now also report results for a specification in which we do not impose some of the restrictions of the initial papers we follow to increase our sample sizes.

Table 4 directly reports the change in the variance of cash-flow news after the dividend event relative to before as a fraction of the average variance before the event. In Panel A, we estimate one VAR for the whole sample period and then use the estimate for Γ to calculate both residuals in the five years before and after the dividend event and the cash flow news.[19] In Panel B, we combine the previous two approaches and estimate one VAR across all firms and events to get an estimate of Γ, but then estimate separate VARs before and after each dividend events to get residuals. Panel C requires only 12 non-missing quarters within five years before and after the dividend event and we do not restrict our sample to non-overlapping event windows within firms. We find the variance

[19]Recall cash-flow news are a function of the transition matrix Γ of the VAR, because it is a transformation of the residuals from the VAR.

of cash flow news decreases for dividend increases, initiations, and both jointly after the event relative to before, whereas the variance increases for cuts in dividends, omissions, and both event types jointly.

All three panels confirm our baseline results. Announcements of dividend increases or initiations result in lower volatility of cash flows after the announcement relative to before, whereas announcements of dividend cuts or omissions result in an increased cash-flow volatility.

Structural breaks occurred in many time series during our sample period and one concern might be our results are concentrated in the first half of our sample. For example, return predictability decreased in the 1990s (see Lettau and Van Nieuwerburgh (2007)), clean surplus accounting might also be more likely to break in the same period, and many firms stopped paying dividends (Fama and French (2001)), or started substituting more intensively dividends for repurchases (Grullon and Michaely (2002)). Panel A and B of Table 5 splits our sample in half (1963-1988 and 1989-2015) and repeats our baseline analysis for both subsamples separately.[20]

We see in Panel A results for the early part of our sample are similar to our baseline results: dividend increases and initiations result in lower future volatility of cash flows, whereas dividend cuts and omissions are associated with increases in the volatility of cash-flow news. More importantly, we find in Panel B very similar results despite the various potential structural changes, including a significant change in dividend taxation in the middle of the second period (in 2003). To directly test whether the change in taxation can partially explain our findings, we report in Panel C results for a sample starting in 2003. We find results which are similar to our baseline findings.

The data strongly supports Prediction 1 of our model. Of course, Prediction 1 is about a simple before-after variation, so it cannot discriminate between our baseline setting, our signaling model, or other alternative explanations such as that dividends simply convey information about future cash-flow volatility for other reasons (e.g., agency motives). To dig deeper into the theoretical mechanism underlying our findings, we now examine cross-sectional heterogeneity in the response.

[20]We estimate a constant Γ matrix within each sample to ensure we have enough data points for reliable estimates.

C. Cross-Sectional Heterogeneity

Our results so far confirm the unconditional version of Prediction 1 from our basic setting in Section II. Our model implies a monotonic relation between cash-flow volatility and dividend changes. Accordingly, we now want to test whether the sensitivity of the variance of cash-flow news to changes in dividends is larger for larger changes in dividends.

Table 6 reports the results. We split the announcements into small and large announcements based on the median dividend change within increases and decreases during the announcement quarter. We see in column (1), for large increases in dividends, the variance of cash-flow news drops by more than 19% on average after the announcement. The drop in variance is 8% smaller in column (2) when we instead study increases in dividends which are below the median increase. Column (3) shows the difference is highly statistically significant. We bootstrap the difference to calculate standard errors. Columns (4) and (5) instead show announcements of large dividend cuts drive the increase in cash-flow news variance. The difference is again highly statistically significant (see column (6)).

One concern with our findings so far is that dividend events might coincide with breakpoints in cash-flow volatility and large and mature firms might just increase dividends when they expect lower future volatility. We might just capture an overall market-wide phenomenon for firms with similar observable characteristics, unrelated to dividend changes.

Table 7 considers this alternative explanation. We report the scaled change in the volatility of cash-flow news for our event firms relative to the scaled change in the volatility of cash-flow news of observationally similar firms which do not have dividend events. Specifically, we use a nearest-neighbor algorithm to match firms based on propensity scores. We estimate propensity scores with a logit regression of the treatment indicator on the book-to-market ratio, leverage, age, and size (the same variables we use in our regression analysis of Table 8 below). We see in Table 7 this alternative story cannot explain our findings. Firms which increase their dividends see a large drop of 15% in the variance of their cash-flow news after the announcement relative to before and relative to observationally similar firms which do not have a dividend event. The drop in variance

is similar in magnitude to our baseline specification. For decreases in dividends, instead, we see an increase in the variance of cash-flow news following the cut relative to before and to matched firms.

The results in Tables 6 and 7 confirm these monotonic univariate predictions of our model. We now turn to a regression framework that allows us to control for confounding factors, as well as to tease out the nuanced theoretical mechanism underlying our results. Specifically, for each dividend change in our sample we now estimate a regression of percent changes in cash-flow volatility, $\Delta\sigma_i$, measured from stock returns using the methodology in Section III, on the percent changes in dollar dividends,

$$\Delta\sigma_i = \alpha + \gamma \cdot \Delta D_i + \varepsilon_i. \tag{12}$$

We expect $\gamma < 0$ following Prediction 1. We impose non-overlapping events so we can think of equation (12) as a purely cross-sectional test.

Of course, Prediction 1 is shared by our baseline setting, as well as by our signaling model. Next, we attempt to disentangle the cross-sectional predictions of our signaling model. Specifically, we estimate the following specification

$$\Delta\sigma_i = \alpha + \beta_1 \cdot \Delta D_i + \beta_2 \cdot eps_i + \beta_3 \cdot \Delta D_i \cdot eps_i + \varepsilon_i, \tag{13}$$

where *eps* is earnings per share. Our main coefficient of interest is β_3. According to the baseline setting of II*A.* with precautionary savings but no asymmetric information, we should expect $\beta_3 = 0$. From our signaling model of Section II*B.* instead, we should expect $\beta_3 > 0$. We should also expect $\beta_1 < 0$ as per our baseline Prediction 1, and also $\beta_2 < 0$, reflecting a scale effect. Therefore, by estimating equation (13) we can tease out the nuanced cross-sectional predictions of our signaling model and distinguish it from other explanations driving our baseline univariate results.

Table 8 reports our estimates. Column (1) confirms our baseline finding in a regression framework: dividend changes result in a change in the variance of cash-flow news in the opposite direction. In column (2), we add earnings per share (*eps*) as an additional covariate. Adding *eps* slightly increases the drop in variance following dividend

increases. Firms with higher *eps* have a smaller variance in cash flow news. Column (3) confirms our novel Prediction 2, consistent with our signaling model, and inconsistent with the baseline setting: dividend increases result in a drop in the variance of cash-flow news but this drop is muted for firms with higher *eps*. Column (4) adds a host of potential determinants of cash-flow volatility and dividend payments such as firm age, size, book-to-market, and financial leverage. None of these additional covariates has a large impact on our main estimates of interest. Positive dividend changes are followed by a decline in cash-flow volatility, which is muted for firms with higher earnings per share. Columns (5) to (8) add year and industry fixed effects at the Fama & French 17 industry-level definition and confirm our basic findings.

We show in the Online Appendix that results are robust when we add the initial variance of cash-flow news (see Table A.1) and when we use a different definition of cash (see Table A.3).

D. Returns around Dividend Events

So far, we have shown dividends changes are associated with a reduction in future cash-flow volatility. Consistent with our model, the extent of the reduction depends on the current level of earnings. We also find the reduction in cash-flow volatility is larger for larger dividend increases and decreases relative to small dividend changes. While it is well documented that on average dividend-change announcements are accompanied by like changes in prices, an important and yet unanswered question is whether market participants recognize the link between dividend changes and subsequent changes in cash-flow volatility, as in Prediction 3 from our model.

To this end, we study how the immediate market reaction to dividend changes is related to the subsequent change in cash-flow volatility (and to the dividend change itself). We begin by checking that in our data, as in prior literature, dividends represent good news for investors. Panel A of Table 9 reports the univariate market response to dividend changes in a three-day window bracketing the dividend event. Columns (1) to (3) show a positive announcement returns for dividend increases, dividend initiations, and the pooled sample ranging between 0.7% and 2.7%. For cuts in dividends, columns (4) to (6) show

a negative announcement return of 0.7% and a negative return of 8.7% for omissions.[21]

In Panel B of Table 9, we split the data in two sub-samples by the size of the dividend change. We find in columns (1) to (3) announcement returns for above-median dividend increases are significantly larger than announcement returns for below-median dividend increases; and we find in columns (4) to (6) announcement returns for above-median dividend decreases are significantly larger in absolute terms (that is, they are more negative) than announcement returns for below-median dividend decreases. Together with our earlier results in Table 6, these results indicate larger changes in dividends carry more information, as they are associated with larger announcement returns and larger subsequent changes in cash flow volatility in the opposite direction, consistent with Prediction 3 from our signaling model.

E. Repurchases

We now examine announcements of share repurchases. Unlike dividends, which are sticky and regular, share repurchases tend to be lumpy and infrequent. However, share repurchases are yet another way to return cash to shareholders, and our framework in Section II predicts patterns of cash-flow volatility following announcements of share repurchases similar to the results following announcements of dividend increases and initiation.

Table 10 reports the results for scaled changes in the variance of cash-flow news after the repurchase announcement relative to before. We see in column (1) the variance of cash-flow news is on average 15% lower after the repurchase announcement relative to before. Consistent with our results for changes in dividends and with the predictions of our model, we see in columns (2) to (4) large repurchase announcements are followed by a drop in cash-flow volatility which is more than 4% larger than the drop in variance for repurchase announcements below the median.

Table 11 confirms our baseline announcement return results for repurchases. We see in column (1) an announcement return of about 2% for all repurchase announcements. In columns (2) to (4), we see the announcement return is almost 1.5% larger for large

[21] All results are almost identical when we look at market-adjusted returns.

repurchases relative to other announcements.

These findings imply share-repurchases announcements convey similar information to announcements of dividend increases and initiations. Prior research (e.g., Jagannathan et al. (2000), Grullon and Michaely (2002)) had emphasized differences in the timing and scope of dividends and share repurchases. Our novel result is share repurchases and dividend announcements convey very similar information to the market regarding changes in future cash flow volatility.

VI Alternative Explanations

In this section we discuss alternative explanations to our results. Section VI*A.* examines agency-based explanations, Section VI*B.* examines tax-based explanations, and Section VI*C.* examines behavioral explanations.

A. Agency

An alternative explanation of dividend policy is that dividends can help address managerial agency problems. The fact that cash is paid out to investors as dividends, rather than being wasted in managerial private benefits, represents good news for investors. In addition, paying dividends may expose companies to the possible need to raise external funds in the future, which may further shift control to outside investors and reduce agency problems (e.g., Easterbrook (1984); see also Fluck (1999), Myers (2000), and Lambrecht and Myers (2012) for additional examinations of these ideas).

To nest some of these ideas into the same baseline model of Section II*A.*, we assume the manager bears some private agency costs $c(D_1)$ from paying a dividend D_1, where the function c is convex, i.e., $c' > 0$ and $c'' > 0$.[22] In this setting, the manager chooses the

[22]This formulation is quite standard in corporate finance, and is akin to assuming the existence of (concave) private benefits of control, which increase in a concave manner with the cash flows that are not distributed to the shareholders, $Y - D$.

dividend payment to maximize

$$\max_{D_1} D_1 + \mathbb{E}\left[Y_2\right] - c\left(D_1\right),$$

subject to

$$Y_2 = f\left(I_1\right) + \nu$$

$$D_1 \leq \omega_1$$

The FOC is $1 - f'\left(\omega_1 + Y - D_1 - \frac{a}{2} \cdot \sigma^2\right) - c'\left(D_1\right) \geq 0$. Therefore, we obtain

Prediction 1 (agency).

$$\frac{\partial \sigma^2}{\partial D} = -\frac{2}{a} + \frac{2 \cdot c''\left(D_1\right)}{a\left[f''\left(\omega_1 + Y - D_1 - \frac{a}{2} \cdot \sigma^2\right)\right]} < 0$$

As in the baseline setting and in the signaling model, higher dividends should correlate with lower future cash flow volatility. Two effects at play. First, because of precautionary savings, lower future cash flow volatility implies a higher certainty equivalent income available for future investment opportunities, as in the baseline setting. Second, lower future cash flow volatility makes it more valuable for managers to extract private benefits (re. incur lower agency costs).

Now, however, the reduction in cash-flow volatility following the same dollar of dividend paid should be larger, the *larger* the current earnings:

Prediction 2 (agency).

$$\frac{\partial^2 \sigma^2}{\partial D \partial Y} = -\frac{2 \cdot c''\left(D_1\right) \cdot f'''\left(\omega_1 + Y - D_1 - \frac{a}{2} \cdot \sigma^2\right)}{a\left[f''\left(\omega_1 + Y - D_1 - \frac{a}{2} \cdot \sigma^2\right)\right]^2} < 0$$

Unlike Prediction 2 from the signaling model, here larger current earnings make it easier to extract more private benefits (re. incur lower agency costs), for a given dollar of dividends. The reason is larger earnings allow the manager not only to pay dividends, but also to extract private benefits, holding fixed future investment. Therefore, by examining how the changes in volatility following dividend changes vary in the cross section as a function of the level of earnings, that is, by estimating equation (13), we can shed light

on the economic mechanism driving our results and distinguish between a signaling and an agency theory.

In other words, our theoretical framework provides a cross-sectional test in which the predictions of signaling and agency theory are clear-cut and opposite to one another. As a result, we can let the data differentiate between signaling and agency theories.[23]

We found in Table 8 $\beta_3 > 0$. This result is not only in support of our signaling model but also inconsistent with the predictions of an agency theory nested in our framework.

Beyond our specific framework in which investment opportunities are held fixed, other applications of agency theory predict dividends should imply reduced agency problems, especially when investment opportunities are low (see, e.g., Jensen (1986), DeAngelo et al. (2009), Grullon et al. (2002)). To test this prediction, we employ two proxies for investment opportunities, namely, the book-to-market ratio and idiosyncratic volatility. The book-to-market ratio is a standard proxy for investment opportunities, which has a strong industry component (e.g., see Cohen and Polk (1995) and Daniel et al. (1997)). Idiosyncratic volatility picks up also within-industry variation. According to these applications of agency theory, we would expect the reduction in cash-flow volatility following dividend changes to be larger, the smaller the book-to-market ratio, and the smaller idiosyncratic volatility.

In Panel A of Table 12, we split firms by their ex ante idiosyncratic volatility. Specifically, we first calculate a firms' ex ante idiosyncratic volatility on a four-quarter rolling basis relative to a Fama & French three-factor model using daily data. We then assign a firm into the large idiosyncratic volatility sample if it had a volatility above the 30% percentile of firm volatility in the respective Fama & French 17 industry in the quarter before the dividend event. Large heterogeneity exists in firms' idiosyncratic volatility and our procedure ensures we do not simply split our sample based on industry. We see in columns (1) and (2), dividend increases for firms with large idiosyncratic volatility results in a drop in the average cash-flow volatility of 17% which is almost 5% larger than the drop for firms with low idiosyncratic volatility. The bootstrapped

[23]Bernheim and Wantz (1995) proposed a test to distinguish between signaling and agency theories of dividends, although the conclusions are sensitive to the employed econometric techniques (see Bernhardt et al. (2005)).

difference between the changes in cash-flow volatility within high- and low-volatility firms is highly statistically significant. We find firms with large ex-ante volatility largely drive the increase in cash-flow volatility after announced cuts in dividends with the difference being statistically significant (see columns (4) to (6)).[24]

In Panel B of Table 12, we split firms by their ex ante book-to-market ratio. We find that firms with larger book-to-market ratio experience a larger reduction in cash flow volatility following dividend changes, although the difference between high versus low book-to-market firms is not statistically significant.

We repeat the sample splits also for announcement returns. Panel A of Table 13 reports announcement returns, separately for firms with high and low idiosyncratic volatility. We find larger announcement returns in absolute value for larger dividend increases and decreases relative to small dividend changes and for dividend changes of firms with higher idiosyncratic volatilities.[25] Panel B of Table 13 reports announcement returns, separately for firms with high and low book-to-market ratio. We find very similar announcement returns in both sub-samples.

The results in Tables 12 and 13 are inconsistent with the predictions of agency theory. If anything, they are more consistent with the predictions of signaling, because firms with larger ex ante idiosyncratic volatility drive the findings.

We also examine whether our evidence on share repurchases changes with investment opportunities. In columns (5) to (7) of Table 10 we see the drop in variance is almost twice as large for firms which have higher idiosyncratic volatility compared to other firms in the same Fama & French industry. In unreported tests we find no significant difference in the first moment of cash flows or in the discount rate around share repurchase announcements. In columns (5) to (7) of Table 11, we see returns are larger for firms announcing repurchases with more volatile returns relative to other firms in the same industry. Again, this is inconsistent with the predictions of agency theory.

Taken together, this evidence indicates that agency theory does not explain our evidence on payout policy and cash-flow volatility.

[24]Results for sample splits based on total volatility are similar, see Table A.4 in the Online Appendix.

[25]Again, we find similar results when we split samples based on total volatility, see Table A.5 in the Online Appendix.

While the predictions of agency theory are inconsistent with our novel evidence on cash-flow volatility, clearly agency theory is important and helps explain other aspects of dividend policies. Across tax regimes, Chetty and Saez (2005) and Jacob and Michaely (2017) show a principal-agent perspective helps explain differential firm-level responses to a common change in tax policy. Across countries, La Porta et al. (2000) document firms in countries with better investor protection make higher dividend payouts than do firms in countries with lower investor protection. Furthermore, in countries with more legal protection, high-growth firms had lower payout ratios. These findings support the idea investors use their legal power to force dividends when growth prospects are low, and that an effective legal system provides investors with the opportunity to reduce agency costs by forcing managers to pay out cash. More broadly, the evidence indicates strong legal enforcement is a prerequisite to make sure management has the right incentives to 'convey its quality' through payout policy.

B. Taxes

Many theoretical and empirical papers on dividend policy rely, directly or indirectly, on tax arguments. In some signaling models, the cost of the signal is the deadweight cost of the taxes paid on dividends relative to the (lower) tax that would be paid on capital gains (see, e.g., John and Williams (1985), Bernheim (1991), Chowdhry and Nanda (2005)). In other models (e.g., Shleifer and Vishny (1986) Section V and Allen et al. (2000)), differential taxation across different shareholders (institutions v retail investors) explain dividend policy as a way for corporations to attract institutions as large shareholders.

These tax-based explanations have been undoubtedly insightful and helpful to think about dividend policy. However, since the Jobs and Growth Tax Relief Reconciliation Act of 2003 in the United States, dividends are taxed at the same rate as capital gains, and the personal tax rate for many classes of institutional investors has also been the same. In this more recent tax regime, 2003-2015, we find in Panel C of Table 5 results similar to those we obtained in sub-samples characterized by differential taxation.

As a result, it has become challenging to construct a dividend equilibrium, signaling or otherwise, in which differential taxation plays any role, be it differential corporate

taxation of dividends versus capital gains, or differential personal taxation across different investors. For these reasons, we abstract from taxation in our analysis of dividend policy.

C. Behavioral Views

Another perspective on dividend policy has emphasized behavioral factors. Shefrin and Statman (1984) describe how individual investors might adopt the behavioral rule 'consume only out of dividends' as a self-control device to delay gratification; they also discuss a 'regret aversion' bias whereby individual investors would rather consume out of dividend income, because if they sold shares instead, they may later regret that decision if the share price increases substantially. Baker and Wurgler (2004)'s catering theory posits 'investor sentiment' influences individuals' demand for dividend-paying stocks, and such sentiment for dividends varies over time, with dividend-paying stocks commanding a value premium in some periods and a discount in others. Rational firms will then adjust their dividend decisions in response to the magnitude of the dividend premium or discount in share prices. More recently, Baker et al. (2016) propose a behavioral dividend signaling approach in which rational managers signal cash-flow strength to loss averse investors. This approach still implies that 'unobservable cash earnings' should change in the same direction of dividend changes, which is hardly consistent with our empirical evidence.

VII Conclusion

The notion that changes in dividend policy convey information to the market is intuitive and managers support it in surveys. The strong market reaction to announcements of dividend changes further suggests it *does* contain value-relevant information. But empirical research so far has found no support for signaling in the data: no meaningful relation exists between changes in dividends and changes in future earnings. The literature has focused on the relationship between dividend changes and changes in earnings—the first moment—rather than between dividend changes and changes in earnings volatility—the second moment.

In this paper, we propose a theoretical framework in which firms use payout policy

to signal the riskiness of their future cash flows. The signal is of the "money burning" type in the sense of Spence. To test our predictions, we use the Campbell (1991) return decomposition to estimate cash-flow volatility from data on stock returns. Consistent with the model's predictions, we find cash-flow volatility decreases following dividend increases (and initiations), and cash-flow volatility increases following dividend decreases (and omissions). Furthermore, larger dividend changes are followed by larger changes in cash-flow volatility in the expected direction. In the cross section, we find the same dollar of dividend paid carries a larger information content for future changes in cash-flow volatility the smaller the current earnings, consistent with the signaling model's prediction that the cost of the signal is foregone investment opportunities; and inconsistent with either the predictions of a baseline model with symmetric information, or the predictions of an agency model.

Crucially, the stock market reactions to dividend announcements support our theoretical notion that expected changes in cash-flow volatility represent the information content of dividends. In fact, we find larger changes in cash-flow volatility are associated with larger announcement returns in the expected direction.

We also find results on changes in cash-flow volatility and on the stock market reaction to share repurchase announcements mirroring those around announcements of dividend increases and initiations. Hence, announcements on payout policy do convey information about the riskiness of future cash flows.

Payout policies have attracted voluminous research over the past 60 years, both theoretical and empirical. Our contribution is threefold, first, we provide a novel method in a corporate finance context to measure the first and second moment of expected future cash flows; second, we provide a host of novel facts about cash-flow volatility and payout policy; and third, we offer both a simple model to rationalize our empirical results, and an empirical test to distinguish between alternative (signaling versus agency) explanations of our evidence. Strikingly, our simple static model can rationalize at the same time our novel empirical results on payout policy and expected cash flow volatility, as well as many results from the prior literature. The main takeaway of our analysis is that the riskiness of future cash flows is a novel and central determinant of firms' payout policies. Therefore,

it is crucial to have a robust method to measure cash-flow volatility. To the best of our knowledge, our paper is the first to use an asset pricing method to measure expected cash flows to test theories of corporate finance.

Signaling models in corporate finance have fallen out of favor after empirical research failed to find support for their central predictions that the first moment of earnings should change after dividend changes in the same direction. Our paper shows that it is crucial to consider precisely which moment of the distribution of future cash flows dividend changes might signal. Well beyond our specific application, our evidence suggests to reconsider more broadly the predictions of signaling models in corporate finance and beyond.

References

Allen, F., A. E. Bernardo, and I. Welch (2000). A theory of dividends based on tax clienteles. *The Journal of Finance 55*(6), 2499–2536.

Allen, F. and R. Michaely (2003). Payout policy. *Handbook of the Economics of Finance 1*, 337–429.

Asquith, P. and D. W. Mullins Jr (1983). The impact of initiating dividend payments on shareholders' wealth. *Journal of Business*, 77–96.

Baker, M., B. Mendel, and J. Wurgler (2016). Dividends as reference points: A behavioral signaling approach. *Review of Financial Studies 29*(3), 697–738.

Baker, M. and J. Wurgler (2004). A catering theory of dividends. *The Journal of Finance 59*(3), 1125–1165.

Benartzi, S., R. Michaely, and R. Thaler (1997). Do changes in dividends signal the future or the past? *The Journal of Finance 52*(3), 1007–1034.

Bernanke, B. S. and K. N. Kuttner (2005). What explains the stock market's reaction to federal reserve policy? *The Journal of Finance 60*(3), 1221–1257.

Bernhardt, D., A. Douglas, and F. Robertson (2005). Testing dividend signaling models. *Journal of Empirical Finance 12*(1), 77–98.

Bernheim, B. D. (1991). Tax policy and the dividend puzzle. *The RAND Journal of Economics 22*(4), 455–476.

Bernheim, B. D. and A. Wantz (1995). A tax-based test of the dividend signaling hypothesis. *American Economic Review 85*(3), 532–551.

Bhattacharya, S. (1979). Imperfect information, dividend policy, and "the bird in the hand" fallacy. *Bell Journal of Economics 10*(1), 259–270.

Bhattacharya, S. (1980). Nondissipative signaling structures and dividend policy. *The Quarterly Journal of Economics 95*(1), 1–24.

Brav, A., J. R. Graham, C. R. Harvey, and R. Michaely (2005). Payout policy in the 21st century. *Journal of Financial Economics 77*(3), 483–527.

Brickley, J. A. (1983). Shareholder wealth, information signaling and the specially designated dividend: An empirical study. *Journal of Financial Economics 12*(2), 187–209.

Brooks, L. D. and D. A. Buckmaster (1976). Further evidence on the time series properties of accounting income. *The Journal of Finance 31*(5), 1359–1373.

Campbell, J. and R. Shiller (1988a). The dividend-price ratio and expectations of future dividends and discount factors. *The Review of Financial Studies 43*(3), 661–676.

Campbell, J. and R. Shiller (1988b). Stock prices, earnings, and expected dividends. *Journal of Finance 43*(3), 661–676.

Campbell, J. Y. (1991). A variance decomposition for stock returns. *The Economic Journal 101*(405), 157–179.

Charest, G. (1978). Dividend information, stock returns and market efficiency-ii. *Journal of Financial Economics 6*(2-3), 297–330.

Chetty, R. and E. Saez (2005). Dividend taxes and corporate behavior: Evidence from the 2003 dividend tax cut. *The Quarterly Journal of Economics 120*(3), 791–833.

Cho, I.-K. and J. Sobel (1990). Strategic stability and uniqueness in signaling games. *Journal of Economic Theory 50*(2), 381–413.

Chowdhry, B. and V. Nanda (2005). Repurchase premia as a reason for dividends: a dynamic model of corporate payout policies. *The Review of Financial Studies 7*(2), 321–350.

Cochrane, J. H. (1992). Explaining the variance of Price-Dividend ratios. *The Review of Financial Studies 5*(2), 243–280.

Cochrane, J. H. (2008). The dog that did not bark: A defense of return predictability. *Review of Financial Studies 21*(4), 1533–1575.

Cohen, R. B. and C. K. Polk (1995). An investigation of the impact of industry factors in asset pricing tests. *Unpublished manuscript, University of Chicago*.

Collins, D. W. and S. P. Kothari (1989). An analysis of inter-temporal and cross-sectional determinants of earnings response coefficients. *Journal of Accounting and Economics 11*(2-3), 143–181.

Daniel, K., M. Grinblatt, S. Titman, and R. Wermers (1997). Measuring mutual fund performance with characteristic-based benchmarks. *The Journal of Finance 52*(3), 1035–1058.

DeAngelo, H., L. DeAngelo, and D. J. Skinner (1996). Reversal of fortune dividend signaling and the disappearance of sustained earnings growth. *Journal of Financial Economics 40*(3), 341–371.

DeAngelo, H., L. DeAngelo, and D. J. Skinner (2009). Corporate payout policy. *Foundations and Trends® in Finance 3*(2–3), 95–287.

DeMarzo, P. M. and D. Duffie (1995). Corporate incentives for hedging and hedge accounting. *The review of financial studies 8*(3), 743–771.

Eades, K. M., P. J. Hess, and E. H. Kim (1985). Market rationality and dividend announcements. *Journal of Financial Economics 14*(4), 581–604.

Easterbrook, F. H. (1984). Two agency-cost explanations of dividends. *American Economic Review 74*(4), 650–659.

Easton, P. D. and M. E. Zmijewski (1989). Cross-sectional variation in the stock market response to accounting earnings announcements. *Journal of Accounting and Economics 11*(2-3), 117–141.

Esö, P. and J. Schummer (2009). Credible deviations from signaling equilibria. *International Journal of Game Theory 38*(3), 411–430.

Fama, E. F. (1965). The behavior of stock-market prices. *The Journal of Business 38*(1), 34–105.

Fama, E. F. and K. R. French (2001). Disappearing dividends: changing firm characteristics or lower propensity to pay? *Journal of Financial Economics 60*(1), 3–43.

Fluck, Z. (1999). The dynamics of the manager-shareholder conflict. *The Review of Financial Studies 12*(2), 379–404.

Gonedes, N. J. (1978). Corporate signaling, external accounting, and capital market equilibrium: Evidence on dividends, income, and extraordinary items. *Journal of Accounting Research*, 26–79.

Grullon, G. and R. Michaely (2002). Dividends, share repurchases, and the substitution hypothesis. *The Journal of Finance 57*(4), 1649–1684.

Grullon, G. and R. Michaely (2004). The information content of share repurchase programs. *The Journal of Finance 59*(2), 651–680.

Grullon, G., R. Michaely, and B. Swaminathan (2002). Are dividend changes a sign of firm maturity? *The Journal of Business 75*(3), 387–424.

Jacob, M. and R. Michaely (2017). Taxation and dividend policy: The muting effect of agency issues and shareholder conflicts. *Review of Financial Studies forthcoming*.

Jagannathan, M., C. P. Stephens, and M. S. Weisbach (2000). Financial flexibility and the choice between dividends and stock repurchases. *Journal of Financial Economics 57*(3), 355–384.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review 76*(2), 323–329.

John, K. and J. Williams (1985). Dividends, dilution, and taxes: A signalling equilibrium. *The Journal of Finance 40*(4), 1053–1070.

Kormendi, R. and R. Lipe (1987). Earnings innovations, earnings persistence and stock returns. *The Journal of Business 60*(3), 323–345.

La Porta, R., F. Lopez-de Silanes, A. Shleifer, and R. W. Vishny (2000). Agency problems and dividend policies around the world. *The Journal of Finance 55*(1), 1–33.

Lambrecht, B. M. and S. C. Myers (2012). A Lintner model of payout and managerial rents. *The Journal of Finance 67*(5), 1761–1810.

Lettau, M. and S. Van Nieuwerburgh (2007). Reconciling the return predictability evidence. *Review of Financial Studies*.

Lintner, J. (1956). Distribution of incomes of corporations among dividends, retained earnings, and taxes. *The American Economic Review 46*(2), 97–113.

Mailath, G. J. (1987). Incentive compatibility in signaling games with a continuum of types. *Econometrica 55*(6), 1349–1365.

Michaely, R., R. H. Thaler, and K. L. Womack (1995). Price reactions to dividend initiations and omissions: Overreaction or drift? *The Journal of Finance 50*(2), 573–608.

Miller, M. H. and F. Modigliani (1961). Dividend policy, growth, and the valuation of shares. *The Journal of Business 34*(4), 411–433.

Miller, M. H. and K. Rock (1985). Dividend policy under asymmetric information. *The Journal of Finance 40*(4), 1031–1051.

Myers, S. C. (2000). Outside equity. *The Journal of Finance 55*(3), 1005–1038.

Ou, J. A. and S. H. Penman (1989). Financial statement analysis and the prediction of stock returns. *Journal of Accounting and Economics 11*(4), 295–329.

Penman, S. H. (1983). The predictive content of earnings forecasts and dividends. *The Journal of Finance 38*(4), 1181–1199.

Pettit, R. R. (1972). Dividend announcements, security performance, and capital market efficiency. *The Journal of Finance 27*(5), 993–1007.

Pettit, R. R. (1977). Taxes, transactions costs and the clientele effect of dividends. *Journal of Financial Economics 5*(3), 419–436.

Ramey, G. (1996). D1 signaling equilibria with multiple signals. *Journal of Economic Theory 69*(2), 508–531.

Riley, J. G. (1979). Informational equilibrium. *Econometrica 47*(2), 331–359.

Shefrin, H. M. and M. Statman (1984). Explaining investor preference for cash dividends. *Journal of Financial Economics 13*(2), 253–282.

Shleifer, A. and R. W. Vishny (1986). Large shareholders and corporate control. *Journal of Political Economy 94*(3), 461–488.

Shumway, T. (1997). The delisting bias in CRSP data. *The Journal of Finance 52*(1), 327–340.

Vuolteenaho, T. (2002). What drives firm-level stock returns? *The Journal of Finance 57*(1), 233–264.

Watts, R. (1973). The information content of dividends. *The Journal of Business 46*(2), 191–211.

Figure 1: **Model Solution**

This figure plots the solution of the signaling model of Section IIB. The red line depicts the equilibrium downward sloping relationship between dividends, D_1, and cash flow volatility, σ^2. The worst firm type with the highest variance, σ^2_{max}, sets dividends $D_1^\star$ as in the first-best, full-information case.

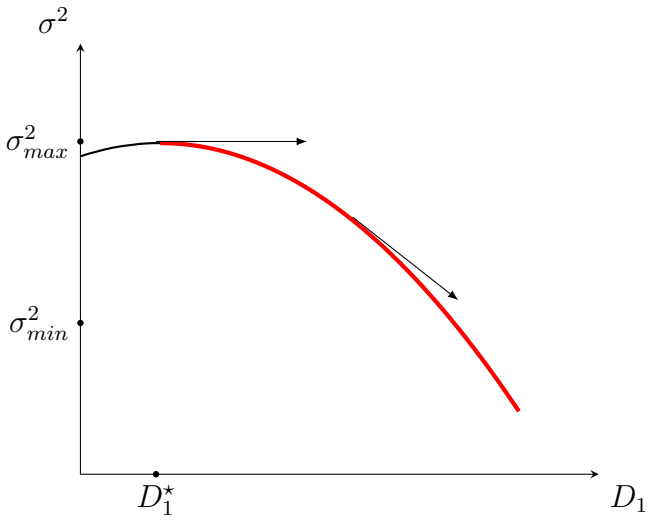


Table 1: **Descriptive Statistics**

This table reports descriptive statistics. $\Delta\,\mathbb{V}\mathrm{ar}(\eta_cf)/mean(\eta_cf)$ *is the scaled change in the variance of cash-flow news around dividend events,* $\Delta\eta_cf$ *is the change in cash-flow news,* $\Delta\eta_dr$ *is the change in discount-rate news, BM Ratio is the book-to-market-ratio, and Market Cap is the market capitalization. We calculate cash-flow and discount-rate news following Vuolteenaho (2002). Our sample period is 1963 till 2015.*

	$\Delta Div > 0$				$\Delta Div < 0$			
	Nobs	Median	Mean	Std	Nobs	Median	Mean	Std
$\Delta\,\mathbb{V}\mathrm{ar}(\eta_cf)/mean(\eta_cf)$	2,441	-0.13	-0.15	0.76	2,461	0.06	0.07	0.83
$\Delta\eta_cf$	2,441	0.00	0.00	0.02	2,461	0.00	0.00	0.02
$\Delta\eta_dr$	2,441	0.00	0.00	0.00	2,461	0.00	0.00	0.00
BM Ratio	2,441	1.05	1.36	3.17	2,461	1.10	1.48	2.97
Market Cap	2,441	0.45	4.34	19.23	2,461	0.44	3.53	13.70
	Initiations				**Omissions**			
	Nobs	Median	Mean	Std	Nobs	Median	Mean	Std
$\Delta\,\mathbb{V}\mathrm{ar}(\eta_cf)/mean(\eta_cf)$	552	-0.06	-0.05	0.92	1,233	0.05	0.06	0.88
$\Delta\eta_cf$	552	0.00	0.00	0.00	1,233	0.00	0.00	0.01
$\Delta\eta_dr$	552	0.00	0.00	0.00	1,233	0.00	0.00	0.00
BM Ratio	552	0.86	1.16	0.95	1,233	1.39	1.93	2.76
Market Cap	552	0.33	1.42	5.29	1,233	0.15	1.88	11.24

Table 2: **Estimate of Transition Matrix of VAR System**

This table reports point estimates of a constant VAR for all firms following the method we outline in Section III. r_t den log book-to-market ratio, and roe is the log return-on-equity. The sample period from 1963 till 2015.

	r	θ	roe
	(1)	(2)	(3)
r	0.02	0.01	0.28
	(2.12)	(9.87)	(13.61)
θ	0.10	0.94	−0.65
	(4.07)	(223.29)	(−9.67)
roe	0.01	−0.02	0.36
	(2.02)	(−29.49)	(28.85)

Table 3: **Change in Cash-Flow and Discount-Rate News Around Dividend Events**

This table reports changes in cash-flow and discount-rate news around dividend events using the methodology of Vuolteenaho (2002) which we describe in Section III. Our sample period is 1963 till 2015.

	$\Delta Div > 0$	Initiation	Pooled	$\Delta Div < 0$	Omission	Pooled
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A. Δ Cash-flow News: $\Delta\eta_cf$					
	-0.0001	0.0000	0.0000	-0.0003	0.0001	-0.0002
	(-0.22)	(0.10)	(-0.22)	(-1.08)	(0.85)	(0.82)
	Panel B. Δ Discount-rate News: $\Delta\eta_dr$					
	0.0000	0.0000	0.0000	-0.0000	0.0000	-0.0000
	(-0.70)	(-0.29)	(-0.65)	(-0.81)	(0.93)	(-0.15)
	Panel C. Δ Variance Cash-flow News: $\Delta\mathbb{V}\mathrm{ar}(\eta_cf)$					
	-0.0015	-0.0006	-0.0013	0.0006	0.0005	0.0006
	(-9.65)	(-1.16)	(-8.35)	(4.38)	(2.42)	(4.95)
	Panel D. Δ Scaled Variance Cash-flow News: $\Delta\mathbb{V}\mathrm{ar}(\eta_cf)/mean(\eta_cf)$					
	-14.86%	-4.56%	-13.04%	7.29%	6.06%	6.09%
	(-9.65)	(-1.16)	(-8.87)	(4.38)	(2.42)	(4.95)
Nobs	2,441	552	2,993	2,461	1,233	3,694

Table 4: **Scaled Change in Variance of Cash-Flow News Around Dividend Events: Robustness**

This table reports changes in cash-flow news around dividend events using the methodology of Vuolteenaho (2002) which we describe in Section III estimating constrained VAR systems. Our sample period is 1963 till 2015.

	$\Delta Div > 0$	Initiation	Pooled	$\Delta Div < 0$	Omission	Pooled
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A. Constant Gamma			
	−14.06%	−6.18%	−12.80%	17.70%	10.50%	15.27%
	(−9.39)	(−1.64)	(−9.10)	(8.13)	(2.42)	(9.01)
			Panel B. Mezzanine Gamma			
	−15.96%	−12.59%	−15.18%	10.72%	14.10%	11.84%
	(−11.47)	(−3.98)	(−11.80)	(6.57)	(5.79)	(8.70)
Nobs	2,441	552	2,993	2,461	1,233	3,964
			Panel C. Extended Sample			
	−15.61%	−5.48%	−13.91%	6.07%	6.09%	6.08%
	(−5.07)	(−0.05)	(−4.84)	(1.94)	(2.42)	(2.40)
Nobs	4,869	983	5,852	4,709	1,233	5,942

Table 5: **Scaled Change in Variance of Cash-Flow News Around Dividend Events: Sample Split**

This table reports changes in cash-flow news around dividend events using the methodology of Vuolteenaho (2002) which we describe in Section III. Panel A reports results for the first half of the sample, Panel B reports results for the second half of the sample, and Panel C reports results for a sample from 2003 until 2015.

	$\Delta Div > 0$	Initiation	Pooled	$\Delta Div < 0$	Omission	Pooled
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A. 1963 – 1988			
	−12.53%	−11.97%	−12.55%	8.23%	11.19%	9.36%
	(−6.34)	(−1.66)	(−6.55)	(3.90)	(3.79)	(5.46)
Nobs	1,155	114	1,269	1,175	715	1,890
			Panel B. 1989 – 2015			
	−15.47%	−4.80%	−12.89%	16.61%	8.43%	13.16%
	(−6.69)	(−1.09)	(−6.29)	(6.02)	(2.54)	(6.23)
Nobs	1,286	438	1,724	1,286	904	2,190
			Panel C. 2003 – 2015			
	−11.31%	−10.58%	−11.13%	20.31%	18.59%	19.58%
	(−2.99)	(−1.49)	(−3.32)	(3.91)	(3.05)	(4.95)
Nobs	848	287	1,135	609	441	1,050

Table 6: **Scaled Change in Variance of Cash-Flow News Around Dividend Events: Heterogeneity**

This table reports changes in cash-flow news around dividend events using the methodology of Vuolteenaho (2002) which we describe in Section III. The Table splits dividend events by the size of the dividend change using the median dividend payment within quarter as cutoff. Our sample period is 1963 till 2015.

	$\Delta Div > 0$			$\Delta Div < 0$		
	Large Increase	Small Increase	Δ	Large Cut	Small Cut	Δ
	(1)	(2)	(3)	(4)	(5)	(6)
	−19.02%	−10.56%	−8.11%	8.64%	5.95%	2.42%
	(−8.28)	(−5.18)	(−22.98)	(3.61)	(2.57)	(6.01)
Nobs	1,243	1,198		1,230	1,231	

Table 7: **Scaled Change in Variance of Cash-Flow News Around Dividend Events: Matched Sample**

This table reports scaled changes in cash-flow news around dividend events using the methodology of Vuolteenaho (2002) which we describe in Section III. The table reports scaled changes in the variance of cash-flow news for firms with dividend events relative to scaled changes in the variance of cash flow news for similar firms without dividend events. We match firms based on the propensity score. Our sample period is 1963 till 2015.

	$\Delta Div > 0$	Initiation	Pooled	$\Delta Div < 0$	Omission	Pooled
	(1)	(2)	(3)	(4)	(5)	(6)
	-14.81%	-4.12%	-12.93%	7.25%	5.36%	6.68%
	(-9.57)	(-1.17)	(-9.10)	(4.32)	(2.27)	(4.87)
Nobs	2,401	513	2,914	2,419	1,051	3,470

Table 8: **Regression of Changes in Variance of Cash-Flow News Around Dividend Events**

This table reports results of regressing changes in the variance of cash-flow news around dividend events using the methodology of Vuolteenaho (2002) which we describe in Section III on the dividend change, earnings per share, the interaction between the two, as well as additional covariates with t-statistics in parentheses. We cluster standard errors at the dividend-quarter level. Our sample period is 1963 till 2015.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔDiv	−0.26	−0.24	−0.37	−0.35	−0.15	−0.14	−0.25	−0.23
	(−5.55)	(−5.31)	(−5.94)	(−6.06)	(−4.92)	(−4.66)	(−5.01)	(−5.00)
eps		−0.17	−0.12	−0.17		−0.14	−0.10	−0.11
		(−1.56)	(−1.87)	(−2.71)		(−1.41)	(−1.75)	(−1.76)
$\Delta Div \times eps$			0.24	0.21			0.19	0.18
			(3.12)	(3.19)			(2.64)	(2.51)
Age				0.00				0.00
				(1.37)				(1.20)
Book-to-market				28.21				132.62
				(0.33)				(2.41)
Leverage				−0.35				−0.14
				(−2.54)				(−1.13)
Size				0.05				0.01
				(3.06)				(1.10)
Constant	0.03	0.12	0.08	−0.86				
	(0.45)	(1.22)	(1.01)	(−2.75)				
Year FE					X	X	X	X
Industry FE					X	X	X	X
R2	2.06%	2.89%	3.89%	5.11%	30.60%	31.15%	31.80%	32.24%
Nobs	3,127	3,127	3,127	3,127	3,127	3,127	3,127	3,127

Table 9: **Announcement Returns**

This table reports three-day cumulative returns on dividend event days for a sample period from 1963 till 2015. Panel A reports our baseline results. Panel B splits dividend events by the size of the dividend change using the median dividend payment within quarter as cutoff.

	$\Delta Div > 0$	Initiation	Pooled	$\Delta Div < 0$	Omission	Pooled
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A. Baseline					
	0.72%	2.73%	1.09%	-0.70%	-8.68%	-3.38%
	(7.69)	(8.69)	(11.27)	(-6.11)	(-29.77)	(-24.37)
Nobs	2,441	552	2,993	2,461	1,233	3,694
	$\Delta Div > 0$			$\Delta Div < 0$		
	Large Increase	Small Increase	Δ	Large Cut	Small Cut	Δ
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel B. Heterogeneity					
	0.76%	0.67%	0.05%	-1.14%	-0.25%	-0.85%
	(5.68)	(5.19)	(2.46)	(-6.09)	(-1.97)	(-37.62)
Nobs	1,243	1,198		1,230	1,231	

Table 10: **Change in Cash-Flow and Discount-Rate News Around Repurchases**

This table reports changes in cash-flow news around share repurchases using the methodology of Vuolteenaho (2002) which we describe in Section III. Our sample period is 1980 till 2015.

	Baseline	Large Repurchase	Small Repurchase	Δ	Large Vol	Small Vol	Δ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	−14.79%	−18.42%	−13.00%	−4.32%	−21.61%	−10.20%	−11.98%
	(−6.51)	(−4.46)	(−3.06)	(−7.30)	(−4.24)	(−3.20)	(−22.75)
Nobs	2,662	1,331	1,331		1,286	1,376	

Table 11: **Announcement Returns: Repurchases**

This table reports three-day cumulative returns on announcements of repurchases for a sample period from 1980 till 2015.

	Baseline	Large Repurchase	Small Repurchase	Δ	Large Vol	Small Vol	Δ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	1.91%	2.62%	1.19%	1.41%	2.55%	1.30%	1.32%
	(12.11)	(10.15)	(6.68)	(36.01)	(9.19)	(8.28)	(33.70)
Nobs	2,662	1,331	1,331		1,286	1,376	

Table 12: **Scaled Change in Variance of Cash-Flow News Around Dividend Events: Investment Opportunities**

This table reports changes in cash-flow news around dividend events using the methodology of Vuolteenaho (2002) which we describe in Section III. Panel A splits dividend events by firms' idiosyncratic volatility. Panel B splits events by firms' book-to-market ratio. Our sample period is 1963 till 2015.

	$\Delta Div > 0$			$\Delta Div < 0$		
	Large Vol	Small Vol	Δ	Large Vol	Small Vol	Δ
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A. Idiosyncratic Volatility					
	−17.27%	−12.89%	−4.73%	11.43%	3.07%	8.41%
	(−6.98)	(−6.66)	(−12.57)	(4.60)	(1.38)	(25.76)
Nobs	1,102	1,339		1,244	1,217	
	$\Delta Div > 0$			$\Delta Div < 0$		
	High BM	Low BM	Δ	High BM	Low BM	Δ
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel B. Book-to-Market					
	−14.89%	−14.84%	−0.05%	8.00%	6.57%	1.42%
	(−6.74)	(−6.91)	(−0.01)	(3.49)	(2.72)	(0.43)
Nobs	1,245	1,216		1,245	1,216	

Table 13: **Announcement Returns: Investment Opportunities**

This table reports three-day cumulative returns on dividend event days for a sample period form 1963 till 2015. Panel A splits dividend events by firms' idiosyncratic volatility. Panel B splits events by firms' book-to-market ratio. Our sample period is 1963 till 2015.

	$\Delta Div > 0$			$\Delta Div < 0$		
	Large Vol	Small Vol	Δ	Large Vol	Small Vol	Δ
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A. Idiosyncratic Volatility					
	0.79%	0.65%	0.16%	−0.83%	−0.57%	−0.27%
	(4.78)	(6.47)	(6.58)	(−4.34)	(−4.55)	(−11.09)
Nobs	1,243	1,198		1,230	1,231	
	$\Delta Div > 0$			$\Delta Div < 0$		
	High BM	Low BM	Δ	High BM	Low BM	Δ
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel B. Book-to-Market					
	0.75%	0.62%	0.13%	−0.65%	−0.65%	0.00%
	(6.97)	(6.13)	(0.90)	(−4.98)	(−5.42)	(−0.01)
Nobs	1,219	1,222		1,245	1,216	

Online Appendix: The Information Content of Dividends: Safer Profits, not Higher Profits

Roni Michaely, Stefano Rossi, and Michael Weber

Not for Publication

I Theoretical Appendices

In this Section we present our theoretical proofs. Appendix A verifies that the six assumptions given by Riley (1979) hold for our signaling model in Sections IIB-IID. Henceforth we refer to the best separating equilibrium outcome discussed in the text as the "Riley outcome". Appendix B verifies that the assumptions of Theorem 1, Theorem 2 and Corollary of Mailath (1987) hold for our signaling model, which implies that the Riley outcome is the unique separating equilibrium of our model. Appendix C verifies that the assumptions of Theorem 1 of Esö and Schummer (2009) hold for our signaling model, which implies that the Riley outome is the unique equilibrium that survives the "credible deviations" refinement (Esö and Schummer (2009); see also Cho and Sobel (1990) and Ramey (1996)). Appendix D states Theorem 1, Theorem 2 and Corollary of Mailath (1987). Appendix E states Theorem 1 of Esö and Schummer (2009). Appendix F presents an example with the log production function. Appendix G proves the main comparative statics results.

A. Proof of Riley (1979) conditions

This Section shows that our model satisfies the Riley (1979) conditions for signaling games.

Proof. Let

$$\begin{aligned} W &= k \cdot V^s + (1-k) \cdot V^h \\ V^s &= D_1 + f\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2(D_1) - D_1\right) \\ V^h &= D_1 + f\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2 - D_1\right), \end{aligned}$$

so that

$$W = D_1 + k \cdot f\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2(D_1) - D_1\right) + (1-k) \cdot f\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2 - D_1\right).$$

Riley (1979) assumptions:

A1. The unobservable attribute, σ^2, is distributed on $[\sigma^2_{min}, \sigma^2_{max}]$ according to a strictly increasing distribution function

A2. The functions $W(\cdot)$, $V^h(\cdot)$ are infinitely differentiable in all variables

A3. $\frac{\partial W}{\partial V^s} > 0$

A4. $V^h(-\sigma^2, D_1) > 0$; $\frac{\partial V^h\left(-\sigma^2, D_1\right)}{\partial -\sigma^2} > 0$

A5. $\frac{\partial}{\partial(-\sigma^2)}\left(\frac{-\frac{\partial W}{\partial D_1}}{\frac{\partial W}{\partial V^s}}\right) < 0$

A6. $W\left(-\sigma^2; D_1, V^h(-\sigma^2, D_1)\right)$ has a unique maximum over D_1.

Assumptions **A1-A4** are immediate.

Condition **A5** is also known as the "single crossing condition" of signaling games and is that $\frac{\partial}{\partial(-\sigma^2)}\left(\frac{-\frac{\partial W}{\partial D_1}}{\frac{\partial W}{\partial V^s}}\right) < 0$

$\frac{\partial W}{\partial D_1} = 1 - f'\left(\omega_1 + Y - \frac{a}{2}\cdot\sigma^2 - D_1\right)$

$\frac{\partial W}{\partial V^s} = k.$

Hence:

$$\frac{\partial}{\partial(-\sigma^2)}\left(\frac{-\frac{\partial W}{\partial D_1}}{\frac{\partial W}{\partial V^s}}\right) = \frac{\partial}{\partial(-\sigma^2)}\left(\frac{-1 + f'\left(\omega_1 + Y - \frac{a}{2}\cdot\sigma^2 - D_1\right)}{k}\right) = \frac{a\cdot f''\left(\omega_1 + Y - \frac{a}{2}\cdot\sigma^2 - D_1\right)}{2k} < 0.$$

Condition **A6** requires $V^h(-\sigma^2, D_1)$ has a unique maximum over D_1, which it does at the point on the downward sloping curve shown in the Figure 1 (in red) which starts from $D^\star$.

■

Because the Riley conditions are satisfied, we refer to the separating equilibrium of Section IIC in the main text as the "Riley equilibrium" and to the separating equilibrium outcome of Section IIC in the main text as the "Riley outcome".

B. Uniqueness of the separating equilibrium

This section shows that the Riley equilibrium is the unique separating equilibrium of our model.

According to Theorem 1, Theorem 2 and Corollary in Mailath (1987) (see Appendix D), if the payoff function satisfies Mailath (1987)'s conditions (1)-(5) and the single crossing condition (7), together with the initial value condition (6), then the Riley equilibrium is the unique separating equilibrium solution.

In the dividend framework, the set of possible types is the interval $[\sigma^2_{min}, \sigma^2_{max}] \subset \mathbb{R}$ and the set of possible actions is $\mathbb{R}$. Let $\tau^{-1}(D_1) = \sigma^2(D_1)$ where $\tau : [\sigma^2_{min}, \sigma^2_{max}] \to \mathbb{R}$ is the proposed equilibrium one-to-one strategy.

Recall

$$\begin{aligned} W &= k \cdot V^s + (1-k) \cdot V^h \\ V^s &= D_1 + f\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2(D_1) - D_1\right) \\ V^h &= D_1 + f\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2 - D_1\right), \end{aligned}$$

so the expected payoff function is

$$W = D_1 + k \cdot f\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2(D_1) - D_1\right) + (1-k) \cdot f\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2 - D_1\right) \quad \text{(A.1)}$$

As we have already shown $\sigma^2(D_1)$ (*i.e.*, $\tau^{-1}(D_1)$) solves the optimization problem, and it satisfies *incentive compatibility*:

$$(IC) \quad \tau(\sigma^2) \in \underset{D_1 \in \tau\left([\sigma^2_{min}, \sigma^2_{max}]\right)}{\operatorname{argmax}} U\left(\sigma^2, \tau^{-1}(D_1), D_1\right), \ \forall \sigma^2 \in [\sigma^2_{min}, \sigma^2_{max}]$$

Mailath (1987)'s regularity conditions on the payoff function W,

1. $W\left(\sigma^2, \sigma^2(D_1), D_1\right)$ is C^2 on $[\sigma^2_{min}, \sigma^2_{max}]^2 \times \mathbb{R}$ (smoothness)

2. W_2 never equals zero, and so is either positive or negative (belief monotonicity)

3. W_{13} never equals zero, and so is either positive or negative (type monotonicity)

4. $W_3\left(\sigma^2, \sigma^2, D_1\right) = 0$ has a unique solution in D_1, denoted $\phi\left(\sigma^2\right)$, which maximizes $W\left(\sigma^2, \sigma^2, D_1\right)$, and $W_{33}\left(\sigma^2, \sigma^2, \phi\left(\sigma^2\right)\right) < 0$ ("strict" quasi-concavity)

5. there exists $k > 0$ such that for all $(\sigma^2, D_1) \in [\sigma^2_{min}, \sigma^2_{max}] \times \mathbb{R}$ $W_{33}\left(\sigma^2, \sigma^2, D_1\right) \geq 0 \Rightarrow \mid W_3\left(\sigma^2, \sigma^2, D_1\right) \mid > k$ (boundedness).

   The other two conditions which play a role in what follows are

6. $\tau\left(\sigma^2_w\right) = \phi\left(\alpha^2_w\right)$, where $\sigma^2_w = \sigma^2_{max}$ if $W_2 < 0$ and σ^2_{min} if $W_2 > 0$ (initial value)

7. $\frac{W_3\left(\sigma^2, \sigma^2(D_1), D_1\right)}{W_2\left(\sigma^2, \sigma^2(D_1), D_1\right)}$ is a strictly monotonic function of σ^2 (single crossing).

Condition (1) is satisfied because it is obvious that $W\left(\sigma^2, \sigma^2(D_1), D_1\right)$ is C^2 on $\left[\sigma^2_{min}, \sigma^2_{max}\right]^2 \times \mathbb{R}$.

Condition (2) is satisfied because W_2 is always negative and will never be zero.

$$W_2 = \frac{\partial W}{\partial \sigma^2(D_1)} = -\frac{k \cdot a}{2} f'\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2(D_1) - D_1\right) < 0 \tag{A.2}$$

since $f'(\cdot) > 0$.

Condition (3) is satisfied because $W_{13} < 0$ is always negative and will never equal zero.

$$\begin{aligned} W_{13} &= \frac{\frac{\partial W}{\partial \sigma^2}}{\partial D_1} \\ &= \frac{-\frac{(1-k) \cdot a}{2} f'\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2 - D_1\right)}{\partial D_1} \\ &= \frac{(1-k) \cdot a}{2} f''\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2 - D_1\right) < 0 \end{aligned}$$

since $f''(\cdot) < 0$.

Condition (4) is satisfied because $f'(\cdot) > 0$ is monotonically increasing.

$$\begin{aligned} W_3\left(\sigma^2, \sigma^2, D_1\right) &= 0 \\ \Longleftrightarrow & \\ 1 - f'\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2 - D_1\right) &= 0. \end{aligned}$$

Since $f'(\cdot) > 0$ is monotonically increasing, $W_3\left(\sigma^2, \sigma^2, D_1\right) = 0$ has a unique solution in D_1, denoted $\phi(\sigma^2)$. It is easy to show that $\phi(\sigma^2)$ also maximizes $W\left(\sigma^2, \sigma^2, D_1\right)$.

$W\left(\sigma^2, \sigma^2, D_1\right) = D_1 + f\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2 - D_1\right)$

To find the optimal D_1 that maximizes $W\left(\sigma^2, \sigma^2, D_1\right)$, the FOC is $W_3\left(\sigma^2, \sigma^2, D_1\right) = 0$ which is already shown above and the second-order condition is $W_{33}\left(\sigma^2, \sigma^2, D_1\right) < 0$ which

is shown below,

$$\begin{aligned} W_{33}\left(\sigma^2,\sigma^2,D_1\right) &= \frac{\partial W_3}{\partial D_1} \\ &= \frac{1-f'\left(\omega_1+Y-\frac{a}{2}\cdot\sigma^2-D_1\right)}{\partial D_1} \\ &= f''\left(\omega_1+Y-\frac{a}{2}\cdot\sigma^2-D_1\right)<0 \end{aligned}$$

since $f''(\cdot)<0$.

Condition (5) is satisfied because if for all $(\sigma^2,D_1) \in [\sigma^2_{min},\sigma^2_{max}]\times\mathbb{R}$ $W_{33}\left(\sigma^2,\sigma^2,D_1\right)\geq 0$ there exist some $k>0$ such that $\mid W_3\left(\sigma^2,\sigma^2,D_1\right)\mid > k$.

$$\begin{aligned} W_{33}\left(\sigma^2,\sigma^2,D_1\right) &\geq 0 \\ \Longleftrightarrow & \\ f''\left(\omega_1+Y-\frac{a}{2}\cdot\sigma^2-D_1\right) &\geq 0. \end{aligned}$$

Thus, to maximize the expected payoff function, the manager will never choose $D_1^\star(\sigma^2)$ where $D_1^\star(\sigma^2)$ is the solution of $1-f'\left(\omega_1+Y-\frac{a}{2}\cdot\sigma^2-D_1\right)=0$. The reason is that $D_1^\star(\sigma^2)$ will minimize the expected utility payoff function instead of maximizing it.

$$W_3 = 1-f'\left(\omega_1+Y-\frac{a}{2}\cdot\sigma^2-D_1\right)\neq 1-f'\left(\omega_1+Y-\frac{a}{2}\cdot\sigma^2-D_1^\star(\sigma^2)\right)=0 \quad \text{(A.3)}$$

Thus, $\mid W_3\left(\sigma^2,\sigma^2,D_1\right)\mid > 0$. It means we can always find some $k>0$ such that $\mid W_3\left(\sigma^2,\sigma^2,D_1\right)\mid > k$.

The next step is to show that both the initial value condition and the single crossing condition hold.

Condition (6) holds because $W_2<0$, in the solution proposed the worst type firm behaves as if they are in the full information case in equilibrium, i.e. $\tau(\sigma^2_{max})=\phi(\sigma^2_{max})$.

Condition (7) holds because

$$
\begin{aligned}
W_3\left(\sigma^2, \sigma^2(D_1), D_1\right) &= 1 - k \cdot f'\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2(D_1) - D_1\right) \\
&\quad -\frac{k \cdot a}{2} f'\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2(D_1) - D_1\right) \frac{\partial \sigma^2(D_1)}{\partial D_1} \\
&\quad -(1-k) \cdot f'\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2 - D_1\right) \\
W_2\left(\sigma^2, \sigma^2(D_1), D_1\right) &= \frac{\partial W}{\partial \sigma^2(D_1)} \\
&= -\frac{k \cdot a}{2} f'\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2(D_1) - D_1\right) \\
\text{Then, } \frac{\partial \frac{W_3\left(\sigma^2, \sigma^2(D_1), D_1\right)}{W_2\left(\sigma^2, \sigma^2(D_1), D_1\right)}}{\partial \sigma^2} &= -\frac{a}{2} \cdot \frac{2(1-k)}{k \cdot a} \frac{f''\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2(D_1) - D_1\right)}{f'\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2(D_1) - D_1\right)} \\
&= -\frac{1-k}{k} \cdot \frac{f''\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2(D_1) - D_1\right)}{f'\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2(D_1) - D_1\right)} > 0
\end{aligned}
$$

Thus $\frac{W_3\left(\sigma^2, \sigma^2(D_1), D_1\right)}{W_2\left(\sigma^2, \sigma^2(D_1), D_1\right)}$ is a strictly increasing function of σ^2.

Since Mailath (1987)'s conditions (1)-(7) are satisfied, the Riley equilibrium is the unique separating equilibrium of our model.

C. Equilibrium Refinement and Uniqueness

In this Section we want to show that our game belongs to the class of monotonic signaling games discussed in Section 3 of Esö and Schummer (2009), (see also Cho and Sobel (1990) and Ramey (1996)) and thus we can apply theorem 1 of Esö and Schummer (2009) to show that on this game the Riley equilibrium (i.e., the unique separating equilibrium as per above) is also the unique equilibrium that is immune to Credible Deviations.

First, let's check the 5 assumptions of Esö and Schummer (2009), A1 to A5, one by one. The firm (Sender) with variance σ^2 (type) decides to distribute D_1 (signal). The investors (receivers) in the market buy the share of the firm at value V^s in the belief that the dividend D_1 reflect the value of the firm as a function of the unobserved variance, which can be denoted as $\hat{\sigma}^2(D_1)$.

A1. $W(-\sigma^2, D_1, -\hat{\sigma}(D_1))$ is strictly increasing in $-\hat{\sigma}(D_1)$ for all $(-\sigma^2, D_1)$.

One can think of $-\hat{\sigma}(D_1)$ as some sort of compensation for the Sender. In order to avoid solutions involving arbitrarily large messages and actions we assume that $\lim_{D_1 \to \infty} W(-\sigma^2, D_1, -\hat{\sigma}(D_1)) = -\infty$.

Proof. According to the proof of Mailath (1987)'s condition (1) above, this assumption obviously holds. ■

A2. Assume that V^s is such that, for any type σ^2 and message D_1, the Receiver has a unique best response (BR), i.e. that $BR(-\sigma^2, D_1)$ is a singleton. **Proof.** Since V^s is strictly increasing in $\hat{\sigma}^2(D_1)$ and by A5 and monotonicity, the receiver knows the sender will choose an optimal D_1 which is a singleton given the type σ^2 with information consistency. So the response of the receiver is also a singleton in equilibrium. ■

A3. Assume $\dfrac{\partial V^s}{\partial(-\hat{\sigma}^2(D_1))}$ is strictly increasing in $-\sigma^2$ for all $(D_1, -\hat{\sigma}^2(D_1))$. **Proof.**

$$\frac{\partial V^s}{\partial(-\hat{\sigma}^2(D_1))} = \frac{a}{2} f'(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2(D_1)).$$

Thus,

$$\begin{aligned} \frac{\dfrac{\partial V^s}{\partial(-\hat{\sigma}^2(D_1))}}{\partial(-\sigma^2)} &= \frac{\dfrac{a}{2} f'(\omega_1 + Y - D_1 - \dfrac{a}{2}\sigma^2(D_1))}{\partial(-\sigma^2)} \\ &= \frac{\dfrac{a}{2} f'(\omega_1 + Y - D_1 - \dfrac{a}{2}\sigma^2(D_1))}{\partial D_1} \cdot \frac{\partial D_1}{\partial(-\sigma^2)} > 0 \end{aligned}$$

■

A4. Assume the game satisfies the central assumption in Spencian signaling games, the single-crossing condition, that is, $-(\partial W/\partial D_1)/(\partial V^s/\partial(-\hat{\sigma}^2(D_1)))$ is strictly decreasing in $-\sigma^2$.

Proof. According to the proof of Mailath (1987)'s condition (7), and of Riley's condition (5) this assumption obviously holds. ■

A5. Assume that $W(-\sigma^2, D_1, -\sigma^2(D_1))$ is strictly quasi-concave in D_1.

Proof. According to the proof of Mailath (1987)'s condition (4), this assumption obviously holds. ■

D. Mailath (1987)

This Section states results in Mailath (1987) that are used above.

Suppose the set of possible types is the interval $[m, M] \subset \mathbb{R}$ and the set of possible actions is $\mathbb{R}$. If $\tau : [m, M] \to \mathbb{R}$ is an equilibrium one-to-one strategy for the informed agent, then when he chooses $y \in \tau([m, M])$ the uninformed agents infer his type is $\tau^{-1}(y)$. Thus, his expected payoff is $U(\alpha, \tau^{-1}(y), y)$. Furthermore, τ is an optimal strategy for the informed agent, so that $\tau(\alpha)$ maximizes the expected payoff. So, for τ to be a separating equilibrium strategy it must be one-to-one and satisfy *incentive compatibility* (IC):

$$(IC) \quad \tau(\alpha) \in \underset{y \in \tau([m,M])}{\operatorname{argmax}} U(\alpha, \tau^{-1}(y), y), \ \forall \alpha \in [m, M]$$

If $U(\alpha, \tau^{-1}(y), y)$ has no other maximizer for $y \in \tau([m, M])$ for all $\alpha \in [m, M]$, then τ satisfies strict incentive compatibility (SIC), i.e.,

$$(SIC) \quad \tau(\alpha) = \underset{y \in \tau([m,M])}{\operatorname{argmax}} U(\alpha, \tau^{-1}(y), y) \ \forall \alpha \in [m, M].$$

The regularity conditions on U are (where subscripts denote partial derivatives):

1. $U(\alpha, \hat{\alpha}, y)$ is C^2 on $[m, M]^2 \times \mathbb{R}$ (smoothness)

2. U_2 never equals zero, and so is either positive or negative (belief monotonicity)

3. U_{13} never equals zero, and so is either positive or negative (type monotonicity)

4. $U_3(\alpha, \alpha, y) = 0$ has a unique solution in y, denoted $\phi(\alpha)$, which maximizes $U(\alpha, \alpha, y)$, and $U_{33}(\alpha, \alpha, \phi(\alpha)) < 0$ ("strict" quasi-concavity)

5. there exists $k > 0$ such that for all $(\alpha, y) \in [m, M] \times \mathbb{R}$ $U_{33}(\alpha, \alpha, y) \geq 0 \Rightarrow |U_3(\alpha, \alpha, y)| > k$ (boundedness).

   The other two conditions which play a role in what follows are:

6. $\tau(\alpha^w) = \phi(\alpha^w)$, where $\alpha^w = M$ if $U_2 < 0$ and m if $U_2 > 0$ (initial value)

7. $\frac{U_3(\alpha,\hat{\alpha},y)}{U_2(\alpha,\hat{\alpha},y)}$ is a strictly monotonic function of α (single crossing).

Theorem 1 *Suppose (1)-(5) are satisfied and $\tau : [m, M] \to \mathbb{R}$ is one-to-one and satisfies incentive compatibility. Then τ has at most one discontinuity on $[m, M]$, and where it is continuous on (m,M), it is differentiable and satisfies* $(DE) \quad \dfrac{d\tau}{d\alpha} = \dfrac{-U_2(\alpha, \alpha, \tau)}{U_3(\alpha, \alpha, \tau)}$.

Furthermore, if τ is discontinuous at a point, α' say, then τ is strictly increasing on one of $[m, \alpha')$ or $(\alpha', M]$ and strictly decreasing on the other, and the jump at α' is of the same sign as U_{13}.

Theorem 2 *Suppose, in addition, that either the initial value condition on the single crossing condition for $(\hat{\alpha}, y)$ in the graph of τ is satisfied. Then τ is strictly, monotonic on (m, M) and hence continuous and satisfies the differential equation (DE) there. If the initial value condition is satisfied, then in fact τ is continuous on $[m, M]$ and $\dfrac{d\tau}{d\alpha}$ has the same sign as U_{13}.*

The following corollary shows incentive compatibility and the initial value condition together imply uniqueness. Let $\tilde{\tau}$ denote the unique solution to the following restricted initial value problem: (DE), $\tau(\alpha^w) = \phi(\alpha^w)$ and $(d\tau/d\alpha)U_{13} > 0$.

Corollary: suppose (1)-(5) are satisfied and the initial value condition must hold. If τ satisfies incentive compatibility, then $\tau = \tilde{\tau}$.

E. Esö and Schummer (2009)

This Section states results in Esö and Schummer (2009) that are used above.

Define the Sender-Receiver game which is denoted by the tuple (Θ, π, u_S, u_R). The Sender has private information that is summarized by his type $\theta \in \Theta = \{\theta_1, \theta_2, \cdots, \theta_n\} \subset \mathbb{R}$, where $\theta_1 < \theta_2 < \cdots < \theta_n$. The commonly known prior probability that the Sender's type is θ is $\pi(\theta)$. Upon realizing his type, the Sender chooses a message $m \in \mathbb{R}_+$. A strategy for the Sender is a function $M : \Theta \to \mathbb{R}_+$. The Sender and Receiver receive respective payoffs of $u_S(\theta, m, a)$ and $u_R(\theta, m, a)$, which are both continuously differentiable in (m, a).

The Receiver's (posterior) beliefs upon receiving the Sender's message is a function $\mu : \mathbb{R}_+ \to \Delta(\Theta)$, where $\Delta(\Theta)$ refers to the set of probability distributions on Θ. For any message $m \in \mathbb{R}_+$ and any fixed (posterior belief) distribution $\tilde{\pi} \in \Delta(\Theta)$, denote the Receiver's best responses to m (given $\tilde{\pi}$) by $BR(\tilde{\pi}, m) \equiv \text{argmax}_{a \in \mathbb{R}} \mathbb{E}\left[u_R(\theta, m, a) \mid \tilde{\pi}\right]$.

Formalizing Credible Deviations

Definition 1 *(Vulnerability to a Credible Deviation) Given an equilibrium (M, A, μ), we say that an out-of-equilibrium message $m \in \mathbb{R}_+ \backslash M(\Theta)$ is a Credible Deviation if the following condition holds for exact one (non-empty) set of types $C \subseteq \Theta$.*

$$C = \{\theta \in \Theta : u_S^\star(\theta) < \min_{a \in BR(C,m)} u_S(\theta, m, a)\} \tag{A.4}$$

We call C the (unique) Credible Deviators' Club for message m. If such a message exits, the equilibrium is Vulnerable to a Credible Deviation.

Monotonic Signaling Games and the Uniqueness of the Equilibrium

Following Cho and Sobel (1990) and Ramey (1996), monotonic signaling games are defined as follows,

A1. $u_S(\theta, m, a)$ is strictly increasing in a for all (θ, m). One can think of a as some sort of compensation for the Sender. In order to avoid solutions involving arbitrarily large messages and actions we assume that $\lim_{m\to\infty} u_S(\theta, m, a) = -\infty$

A2. Assume that u_R is such that, for any type θ and message m, the Receiver has a unique best response, i.e. that $BR(\theta, m)$ is a singleton

A3. Assume that $\dfrac{\partial u_R}{\partial a}$ is strictly increasing in θ for all (m, a)

A4. Assume the game satisfies the central assumption in Spencian signaling games, the single-crossing condition, that $-(\partial u_S/\partial m)/(\partial u_S/\partial a)$ is strictly decreasing in θ

A5. Assume that $u_S(\theta, m, \beta(\theta, m))$ is strictly quasi-concave in m

An additional piece of notation simplifies the exposition. For any θ and m, let $\hat{a}(\theta, m)$ be the action to satisfy,

$$u_S(\theta, m, \hat{a}(\theta, m)) = u_S^\star(\theta) \tag{A.5}$$

if such an action exists, and denote $\hat{a}(\theta, m) = \infty$ otherwise. This action by the Receiver would give Sender-type θ his equilibrium payoff after sending m. If such an action exists, it is unique by monotonicity.

Lemma 1 (3) *If an equilibrium (M, A, μ) is not Vulnerable to Credible Deviations, it is*

a separating equilibrium - no two types send the same message.

Lemma 2 (4) *Any equilibrium whose outcome is different from the Riley outcome is Vulnerable to Credible Deviations.*

Theorem 1 (1) *The Riley outcome is the unique equilibrium outcome that is not Vulnerable to Credible Deviations.*

F. An Example

For this example, define $f\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2 - D_1\right) = \ln\left(\omega_1 + Y - \frac{a}{2} \cdot \sigma^2 - D_1\right)$

Then, the function

$$1 - f'(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2(D_1)) - \frac{ka}{2} \cdot f'(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2(D_1)) \cdot \frac{\partial \sigma^2}{\partial D_1} = 0$$

given $\sigma^2\left(D_1^*\right) = \sigma^2_{\max}$

becomes

$$\frac{\partial \sigma^2\left(D_1\right)}{\partial D_1} = \frac{2(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2 - 1)}{k \cdot a}.$$

The solution is:

$$\sigma^2\left(D_1\right) = \frac{2(\omega_1 + Y - \frac{a}{2}\sigma^2 - 1)D_1 - D_1^2 + \overline{\sigma^2}a + D_1^{\star 2} - 2(\omega_1 + Y - 1)D_1^\star}{k \cdot a}$$

where $D_1 \geq D_1^\star$.

G. Proof of Comparative Statics

Here we state and prove the main comparative statics.

Prediction 1 (signaling). The dividend changes should be followed by changes in future cash flow volatility in the opposite direction, i.e. $\frac{\partial \sigma^2(D_1)}{\partial D_1} < 0$

Proof. The proof is immediate given the analysis of the schedules in the main text.

Combining the FOC and SOC of the manager's optimization problem we get a simple condition guaranteeing a maximum

$$-V^h_{d\sigma^2}(\sigma^2, D)\frac{\partial \sigma^2}{\partial D_1} < 0 \tag{A.6}$$

With $V^h_{d\sigma^2}(\sigma^2, D) = \frac{a}{2}f''(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2) < 0$, a maximum occurs if and only if $\frac{\partial \sigma^2}{\partial D_1} < 0$.

■

Prediction 2 (signaling). Following a dividend increase (re. decrease), there's a larger decrease (re. increase) in cash flow volatility for firms with smaller (re. larger) current earnings, i.e. $\frac{\partial^2 \sigma(D_1)}{\partial D_1 \partial Y} > 0$

Proof. Recall the FOC,

$$1 - f'(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2) - \frac{ka}{2} \cdot f'(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2(D_1)) \cdot \frac{\partial \sigma^2(D_1)}{\partial D_1} = 0, \tag{A.7}$$

we get

$$\frac{\partial \sigma^2(D_1)}{\partial D_1} = \frac{1 - f'(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2)}{\frac{ka}{2} \cdot f'(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2(D_1))}. \tag{A.8}$$

Then

$$\begin{aligned} \frac{\partial^2 \sigma^2(D_1)}{\partial D_1 \partial Y} &= \frac{\partial\big(\frac{1 - f'(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2)}{\frac{ka}{2} \cdot f'(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2(D_1))}\big)}{\partial Y} \\ &= -\frac{2f''(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2(D_1)}{k \cdot a \cdot \Big[f'(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2(D_1)\Big]^2} > 0 \end{aligned}$$

because $f'' < 0$. ■

Table A.1: **Regression of Changes in Variance of Cash-Flow News Around Dividend Events: Initial Variance**

This table reports results of regressing changes in the variance of cash-flow news around dividend events using the methodology of Vuolteenaho (2002) which we describe in Section III on the dividend change, earnings per share, the interaction between the two, as well as additional covariates with t-statistics in parentheses. We cluster standard errors at the dividend-quarter level. Our sample period is 1963 till 2015.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔDiv	−0.26	−0.24	−0.37	−0.13	−0.15	−0.14	−0.25	−0.11
	(−5.55)	(−5.29)	(−5.94)	(−2.76)	(−4.92)	(−4.64)	(−5.04)	(−2.90)
eps		−0.17	−0.12	−0.22		(−0.14)	(−0.10)	(−0.16)
		(−1.59)	(−1.91)	(−4.41)		(−1.43)	(−1.77)	(−3.21)
$\Delta Div \times eps$			0.24	0.17			0.20	0.16
			3.13	3.18			2.67	2.87
$\mathbb{V}\mathrm{ar}_{t-1}(\eta_cf)$				−93.65				−80.83
				(−29.17)				(−32.08)
Age				0.00				0.00
				(1.23)				(0.24)
Book-to-market				81.87				112.71
				(0.93)				(1.81)
Leverage				0.16				0.14
				(1.36)				(1.33)
Size				0.04				0.01
				(2.57)				(0.87)
Constant	0.03	0.12	0.08	0.09				
	(0.45)	(1.24)	(1.04)	(0.29)				
Year FE					X	X	X	X
Industry FE					X	X	X	X
R2	2.06%	2.89%	3.89%	39.16%	30.60%	31.15%	31.80%	52.24%
Nobs	3,127	3,127	3,127	3,127	3,127	3,127	3,127	3,127

Table A.2: **Regression of Changes in Variance of Cash-Flow News Around Dividend Events**

This table reports results of regressing changes in the variance of cash-flow news around dividend events using the methodology of Vuolteenaho (2002) which we describe in Section III on the dividend change, earnings per share, the interaction between the two, as well as additional covariates with t-statistics in parentheses. We cluster standard errors at the dividend-quarter level. Our sample period is 1963 till 2015.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔDiv	−0.26	−0.24	−0.37	−0.35	−0.15	−0.14	−0.25	−0.23
	(−5.55)	(−5.31)	(−5.94)	(−6.05)	(−4.92)	(−4.66)	(−5.01)	(−5.03)
eps		−0.17	−0.12	−0.18		−0.14	−0.10	−0.23
		(−1.56)	(−1.87)	(−2.76)		(−1.41)	(−1.75)	(−1.78)
$\Delta Div \times eps$			0.24	0.21			0.19	0.18
			(3.12)	(3.20)			(2.64)	(2.54)
Age				0.00				0.00
				(1.44)				(1.21)
Book-to-Market				34.02				134.39
				(0.40)				(2.44)
Leverage				−0.35				−0.14
				(−2.58)				(−1.12)
Size				0.05				0.02
				(3.35)				(1.23)
Cash				−0.00				(−0.00)
				(−2.35)				(−1.40)
Constant	0.03	0.12	0.08	−0.86				
	(0.45)	(1.22)	(1.01)	(−2.75)				
Year FE					X	X	X	X
Industry FE					X	X	X	X
R2	2.06%	2.89%	3.89%	5.24%	30.60%	31.15%	31.80%	32.27%
Nobs	3,127	3,127	3,127	3,127	3,127	3,127	3,127	3,127

Table A.3: **Regression of Changes in Variance of Cash-Flow News Around Dividend Events: Initial Variance**

This table reports results of regressing changes in the variance of cash-flow news around dividend events using the methodology of Vuolteenaho (2002) which we describe in Section III on the dividend change, earnings per share, the interaction between the two, as well as additional covariates with t-statistics in parentheses. We cluster standard errors at the dividend-quarter level. Our sample period is 1963 till 2015.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔDiv	−0.26	−0.27	−0.26	−0.25	−0.15	−0.16	−0.15	−0.14
	(−5.55)	(−5.62)	(−5.47)	(−5.71)	(−4.92)	(−5.11)	(−4.82)	(−4.90)
CF		−0.09	−0.11	−0.09		−0.06	−0.08	−0.08
		(−2.54)	(−3.53)	(−2.87)		(−2.47)	(−3.17)	(−3.20)
$\Delta Div \times CF$			0.02	0.02			0.02	0.02
			(3.05)	(2.91)			(2.40)	(2.62)
Age				0.00				0.00
				(1.38]				(1.23)
Book-to-market				57.49				150.01
				(0.62)				(2.55)
Leverage				−0.33				−0.11
				(−2.43)				(−0.95)
Size				0.03				0.00
				(1.92)				(−0.16)
Constant	0.03	0.03	0.02	−0.53				
	(0.45)	(0.34)	(0.32)	(−1.76)				
Year FE					X	X	X	X
Industry FE					X	X	X	X
R2	2.06%	2.61%	2.75%	3.52%	30.60%	30.80%	30.94%	31.45%
Nobs	3,127	3,127	3,127	3,127	3,127	3,127	3,127	3,127

Table A.4: **Scaled Change in Variance of Cash-Flow News Around Dividend Events: Total Vol**

This table reports changes in cash-flow news around dividend events using the methodology of Vuolteenaho (2002) which we describe in Section III. The Table splits events by firms' total volatility. Our sample period is 1963 till 2015.

	$\Delta Div > 0$			$\Delta Div < 0$		
	Large Vol	Small Vol	Δ	Large Vol	Small Vol	Δ
	(1)	(2)	(3)	(4)	(5)	(6)
	−16.49%	−13.13%	−3.74%	9.61%	3.79%	3.45%
	(−7.23)	(−6.39)	(−6.27)	(4.28)	(1.55)	(4.64)
Nobs	1,262	1,179		1,482	979	

Table A.5: **Announcement Returns: Total Vol**

This table reports three-day cumulative returns on dividend event days for a sample period form 1963 till 2015. The Table splits events by firms' total volatility. Our sample period is 1963 till 2015.

	$\Delta Div > 0$			$\Delta Div < 0$		
	Large Vol	Small Vol	Δ	Large Vol	Small Vol	Δ
	(1)	(2)	(3)	(4)	(5)	(6)
	0.93%	0.48%	0.44%	−0.93%	−0.31%	−0.73%
	(5.97)	(5.10)	(11.15)	(−5.44)	(−2.85)	(16.34)
Nobs	1,262	1,179		1,482	979	