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CEO overconfidence and dividend policy

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ABSTRACT

We develop a model of the dynamic interaction between CEO overconfidence and dividend policy. The model shows that an overconfident CEO views external financing as costly and hence builds financial slack for future investment needs by lowering the current dividend payout. Consistent with the main prediction, we find that the level of dividend payout is about one-sixth lower in firms managed by CEOs who are more likely to be overconfident. We document that this reduction in dividends associated with CEO overconfidence is greater in firms with lower growth opportunities and lower cash flow. We also show that the magnitude of the positive market reaction to a dividend-increase announcement is higher for firms with greater uncertainty about CEO overconfidence.

1. Introduction

The variation in dividend payouts over time and across firms remains one of the major unresolved puzzles in corporate finance, despite an extensive theoretical and empirical literature. In particular, the combined explanatory power of factors like agency problems, asymmetric information, and other market frictions, including taxes, is small compared to the total cross-sectional and time-series variation in dividend choices, leaving much to be explained (Allen and Michaely, 2003; Brav et al., 2005). We examine an alternative explanation based on differences in managerial beliefs. Following Malmendier and Tate (2008, 2005) and Malmendier et al. (2011), we classify managers as "overconfident" if they overinvest personal funds in their own company.[1]

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[1] The finding that people are overconfident is one of the most robust in the psychology of judgment. See De Bondt and Thaler (1995); Kahneman et al. (1982), and Russo and Schoemaker (1990). Overconfidence is defined either as an upward bias in expectations of future outcomes (overoptimism) or as overestimation of the precision of one's information and underestimation of risk. We focus on the first interpretation but our theoretical results obtain with either behavioral bias, as we explain later.

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While the existing literature has explored the implications of CEO overconfidence for investment, merger, and financing decisions, the implications for dividends remain largely unexplored. The literature on dividend policy generally makes it clear that investment and financing decisions alone do not uniquely determine dividends. So, on the one hand, an overconfident CEO may lower dividends if he or she perceives higher investment needs (Ben-David et al., 2007); on the other hand, the CEO may increase dividends if he or she expects higher cash flows from current investment (Wu and Liu, 2011). Thus, the impact of an overconfident CEO's beliefs on dividend policy is an open question, yet to be resolved conceptually and empirically.

We study this issue by developing a dynamic model of the interaction between dividend policy and CEO overconfidence. We show that an overconfident CEO views future external financing as more costly than internal funds and lowers the current dividend payout to increase the amount of internal capital available for future investment needs. This result is driven by the model's assumption that an overconfident CEO overestimates the value of new investments. The main testable prediction of the model is that an overconfident CEO pays lower dividends than does a rational CEO. The model also predicts the effect of CEO overconfidence on the dividend payout to be weaker for firms with higher growth opportunities. In addition, the model predicts the stock price response to announcements of dividend changes to be an increasing function of the informativeness of the announcement about CEO overconfidence.

We test the model's predictions using panel data of large US companies over the period, 1980–1994. We employ the measures of CEO overconfidence derived by Malmendier and Tate (2005, 2008). Our results indicate that the level of dividend payout is lower in firms managed by overconfident CEOs. The marginal reduction in dividend payout in firms managed by overconfident CEOs is about one-sixth of the median dividend payout for the firms in our sample.[2] This result is robust to alternative measures of CEO overconfidence and to several control variables.

We also examine the effect of CEO overconfidence on the relation between dividend policy and growth opportunities, cash flow, and the level of asymmetric information. Consistent with previous evidence, we find a negative relation between growth opportunities and dividend payout. However, the difference in the dividend payout between lower-growth and higher-growth firms is smaller in firms with overconfident CEOs. This finding is consistent with our model's prediction that CEO overconfidence plays a weaker role in higher-growth firms. We also find that the positive relation between dividend payout and cash flow, documented in previous studies, is stronger in firms with overconfident CEOs. This result suggests that overconfident CEOs may overestimate the ability of current cash flow to predict future cash flow. We find an inverse relation between dividend payout and information asymmetry that does not vary across rational and overconfident CEOs.

We conclude with an analysis of the stock market response to announcements of large dividend increases. We estimate a multivariate regression model to investigate the relation between CEO overconfidence and the stock-market response to the dividend-increase announcement. Our results indicate that the magnitude of the positive stock price response is higher for firms with uncertainty about CEO overconfidence than for firms whose CEOs have previously been identified as overconfident. This novel result is consistent with our hypothesis that dividends provide information about CEO overconfidence – dividend increases indicate lower CEO overconfidence – and that this informativeness is higher when there is greater uncertainty about CEO overconfidence.

We make three contributions to the dividend policy literature: First, we model and test the relation between managerial overconfidence and dividend policy to show that CEO overconfidence affects dividend policy. Second, to rule out alternative plausible explanations of our results, we develop a series of other predictions that have not been investigated in the literature. Our tests of these predictions strengthen the overconfidence-based interpretation of our results as well as those in related prior work (e.g., Malmendier and Tate, 2005, 2008). Specifically, we examine the effect of CEO overconfidence on the relation between dividend policy and cash flow, growth opportunities, and the level of asymmetric information. Third, the findings on the stock market response to announcements of dividend increases by overconfident CEOs indicate that the market recognizes the relation between CEO

[2] We call a CEO overconfident if he or she is identified so by our empirical measures, even though we recognize that it is difficult to measure overconfidence precisely and overconfidence is likely to be a continuous variable.

overconfidence and dividend policy. Our results thus provide a new explanation for the stock market response to announcements of dividend changes. Taken together, our results document a robust effect of CEO overconfidence on dividend policy.

Our paper also contributes to the growing literature on behavioral corporate finance. Barberis and Thaler (2003) and Hirshleifer (2001) survey the literature that attempts to explain asset pricing and return patterns based on behavioral characteristics of investors. The literature on behavioral corporate finance that examines the relation between corporate policies and the behavioral characteristics of corporate managers and investors is surveyed by Baker et al. (2007). Hackbarth (2008) shows theoretically that overconfident managers tend to choose higher debt levels. Bernardo and Welch (2001), Gervais et al. (2011), and Goel and Thakor (2008) endogenize CEO overconfidence and consider the impact of CEO overconfidence on shareholders. Heaton (2002) examines how managerial optimism affects corporate policies, de Meza and Southey (1996) and Landier and Thesmar (2009) examine financial contracting with optimistic managers, and Bergman and Jenter (2007) link stock option compensation to employee optimism. Bertrand and Schoar (2003) show that differences in style across managers significantly explain corporate decisions and performance.

Our study is more closely related to the literature that explores the effect of CEO overconfidence on corporate policies. Malmendier and Tate (2005) document that firms managed by overconfident CEOs exhibit a greater sensitivity of investment spending to internal cash flow. Malmendier and Tate (2008) show that overconfident CEOs are more likely to engage in acquisitions that are value-destroying. Malmendier et al. (2011) argue that overconfident managers perceive their firms to be undervalued and are reluctant to raise funds through costly external sources. They document that the reluctance of overconfident CEOs to raise funds through external sources leads to both a pecking order of financing and debt conservatism. Our results are consistent with the central thesis of this literature that behavioral characteristics of CEOs affect corporate finance policies.

The papers that address the relation between managerial overconfidence or overoptimism and dividend policy include Ben-David et al. (2007) and Bouwman (2010). Ben-David et al. (2007) identify miscalibrated Chief Financial Officers based on their forecasts of stock market returns and analyze how this measure is related to corporate policies. Their evidence indicates that firms with miscalibrated CFOs may pay smaller dividends. We focus on CEO overconfidence and get much stronger results with more comprehensive empirical tests. Bouwman (2010) analyzes the stock price reaction to dividend increases by optimistic CEOs. While she does not investigate the impact of CEO overconfidence on dividend policy, she finds that the stock market reacts more positively to dividend increases by optimistic CEOs. Our theoretical analysis provides a more nuanced result that the stock market reaction depends on the extent of uncertainty about CEO overconfidence, and our empirical analysis, which differs from Bouwman (2010), confirms this prediction. Ben-David (2010) surveys the dividend policy literature from a behavioral finance perspective.

The paper proceeds as follows. In Section 2, we develop a model of dividend policy and CEO overconfidence. Section 3 describes the data and method. Section 4 presents the empirical results. Section 5 summarizes our findings and discusses the implications of the study.

2. Model

In this section, we present a parsimonious model of dividend policy and examine how the policies of an overconfident CEO differ from those of the rational CEO. The model formalizes the intuition that overconfident CEOs, who view firm equity as undervalued and external financing as excessively costly, build financial slack for future investment needs by lowering dividend payout. Dividends are determined by a trade-off between minimizing the cost of retaining excess cash in the firm and minimizing the expected cost of external financing for future investment. The CEO is concerned about the cost of external financing because he acts in the interests of original shareholders.

2.1. Model basics

Consider an all-equity firm with a CEO who acts in the interest of original shareholders. The number of shares is normalized to one and all investors are risk neutral. The risk-free interest rate is zero.

There are three dates: dates 1, 2, and 3. The firm invests a fixed amount I_1 at date 1 in a project that produces a known fixed cash flow of X at date 2.[3] Further, at date 1, the CEO observes a signal s about the quality Y of another project in which the firm can invest at date 2. This project, if accepted, requires a fixed investment I on date 2 and yields a cash flow $Yf(I)$ at date 3 where the function f is increasing and concave with $f(0) = 0$. The CEO chooses whether to invest in this project based on his beliefs about the project quality. At each date, the CEO also determines the dividend amount, if any, and the amount of external financing raised, if any.

The project quality Y is a random variable normally distributed with mean μ_y and precision η_y (standard deviation $\frac{1}{\eta_y}$). The CEO's signal s is normally distributed with mean equal to the project quality Y and precision η_s. The expected value of the project quality conditional on the signal s is calculated using Bayes rule as

$$y(s) \equiv E[Y|s] = \frac{\eta_y \mu_y + \eta_s s}{\eta_y + \eta_s}. \tag{1}$$

Thus, the CEO's posterior mean of the project quality is a weighted average of the prior mean μ_y and the signal value s and the weight placed on the signal is increasing in the precision of the signal. While a rational CEO correctly calculates the posterior mean of the project quality, an overconfident CEO's inference is biased. In particular, an overconfident CEO overestimates the mean quality μ_y and hence the posterior mean quality given by (1).[4] A CEO with degree of overconfidence C estimates the posterior mean quality of the project to be $y_C(s)$, which is increasing in both s and C, and equals the value given by (1) if $C = 1$. Thus, $C = 1$ indicates a rational CEO, $C > 1$ indicates an overconfident or overoptimistic CEO, and $C < 1$ indicates a diffident or pessimistic CEO.[5]

The firm starts with a cash balance of $C_0 > I_1$ on date 1. Its cash balance following investment, payout, and financing actions at date $t \in \{1,2,3\}$ is C_t. The firm must maintain non-negative cash balance at dates 1 and 2 and settle all cash flows by date 3 ($C_3 = 0$). The firm may hold an arbitrarily high amount of cash if there is no cost of holding cash. To prevent this unrealistic scenario, we assume that the cash balance is dissipated across dates so that a cash balance of C_t at Date $t \in \{1,2\}$ reduces to $g(C_t)$ at Date $t+1$ where $g(0) = 0$ and $g'(C_t) \leqslant 1$. This assumption is consistent with an opportunity cost of holding liquid assets or an agency cost of maintaining cash as in Jensen (1986). Since the firm can carry cash across dates, the dividend payout is not simply the residual of current investment needs but is also based on expectation of future investment needs.

At date 1, the CEO determines the dividend $D_1 \geqslant 0$ and the amount of external financing F_1, following which, the cash balance of the firm changes to $C_1 = C_0 - I_1 - D_1 + F_1$. We assume that the firm needs external financing at date 1 or at date 2 if it invests in the project at date 2: $I > g(C_0 - I_1) + X$. At date 2, the CEO determines the dividend D_2 and the amount of external financing F_2. The new cash balance C_2 equals $g(C_1) + X - I - D_2 + F_2$ if the CEO invests and $g(C_1) + X - D_2 + F_2$ otherwise. At date 3, the firm distributes to investors the cash carried over from date 2, $g(C_2)$, and the project payoff $Yf(I)$ if it invested in the project at date 2. Fig. 1 summarizes the timeline of events.

[3] The investment at date 1 is not essential for the analysis. The results continue to hold if $I_1 = 0$ and $X = 0$.

[4] Prior literature interprets overconfidence as two related but distinct biases in beliefs (see Daniel et al. (1998) and Glaser and Weber (2010) for reviews of psychological evidence about overconfidence). One definition stipulates that overconfidence is overestimation of future cash flows. This interpretation is sometimes referred to as overoptimism (see Hackbarth, 2008; Heaton, 2002; Hirshleifer, 2001; Malmendier and Tate, 2005). Another definition of overconfidence is overestimation of the precision of one's information (see Barberis and Thaler, 2003; Ben-David et al., 2012; Bernardo and Welch, 2001; Gervais et al., 2011; Hackbarth, 2008; Hirshleifer, 2001; Malmendier and Tate, 2005). Thus, the distinction between the two interpretations is that one is a bias about the first moment of the outcome whereas the other is a bias about the second moment of the outcome. As Hirshleifer (2001) points out, an overestimation of the precision of one's information may lead to overoptimism. Our results about the effect of overconfidence on the CEO's policies hold for both interpretations. While our analysis focuses on a CEO who overestimates mean cash flows (i.e., overoptimism), in a previous version of the paper, we had analyzed policies of a CEO who overestimates the precision of his signal and had obtained similar results.

[5] Our assumption that CEO overconfidence is about uncertain future investment opportunities, rather than the more predictable future cash flow from assets in place, is consistent with the psychological evidence that overconfidence is rampant in difficult tasks and is eliminated in very easy tasks (see Griffin and Tversky, 1992; Klayman et al., 1999).

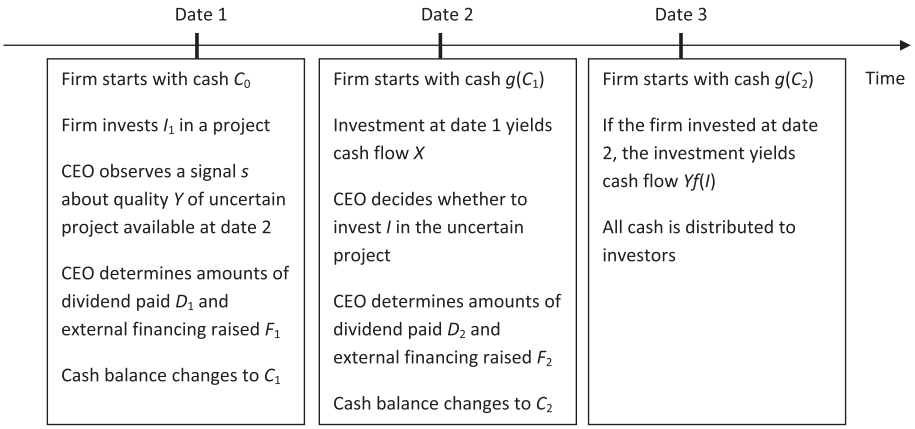

Fig. 1. Timeline.

2.2. Cash policy

We now analyze the cash balance that the firm maintains. First, note that the firm does not hold any cash balance after date 2 ($C_2 = 0$) because holding cash is costly and it is better to pay out cash as a dividend at date 2 rather than at date 3. The firm's actions at date 1 depend on whether the CEO plans to invest at date 2. The CEO bases this decision on the signal he observes at date 1. If he decides not to invest at date 2, the firm does not hold any cash after date 1. If the CEO plans to invest at date 2, the firm may retain cash to reduce the amount of external financing necessary for financing the project at date 2. The firm's actions at date 1 help investors infer the CEO's signal noisily. Based on these actions, everyone can anticipate the equilibrium behavior at date 2 and all uncertainty about date 2 outcomes is resolved at date 1.

2.3. Financing policy

The firm does not raise external financing and pay dividends simultaneously. Raising external financing and paying a dividend simultaneously is a positive-NPV transaction for current shareholders only if the firm's securities are undervalued. So, in equilibrium, new investors will not provide capital for a dividend payout. The firm has sufficient cash for its investment need at date 1 ($C_0 > I_1$). Since there is a cost to retaining cash, the firm prefers to meet any investment need at date 2 by raising external financing at date 2 rather than at date 1. Thus, no external financing is raised at date 1 ($F_1 = 0$). At date 2, the firm raises external financing for investment only if it does not pay any dividend ($D_2 = 0$) or retain cash ($C_2 = 0$). The amount of external financing is just sufficient to bridge the gap between the firm's investment needs and its cash balance: $F_2 = I - g(C_1) - X = I - g(C_0 - I_1 - D_1) - X$.

2.4. Payoff to original shareholders

Let y_C be the CEO's estimate of the project quality and let $y_M(D_1)$ be the market's expectation of the project quality as inferred from dividend D_1. Note that the market need not noiselessly recover the CEO's signal. If the CEO declares the same dividend D_1 for multiple values of y_C, such as a zero dividend for all sufficiently high values of y_C, then D_1 does not uniquely determine y_C. Even when the market can infer y_C, its value depends on the CEO's signal as well as the CEO's overconfidence that is unknown to the market. The CEO believes that the value of the firm after the investment at date 2 equals $y_C f(I)$. The investors' estimate of that value equals $y_M(D)f(I)$. The equity is priced so that new investors at date

2 expect to get a stake which equals their contribution F_2.[6] Thus, the original shareholders retain a fraction $(y_M(D)f(I) - F_2)/(y_M(D)f(I))$ that is decreasing in the amount of external financing raised. The CEO believes that this stake of original shareholders is worth

$$y_C \frac{y_M(D_1)f(I) - I + g(C_0 - I_1 - D_1) + X}{y_M(D_1)}, \tag{2}$$

which is increasing in the CEO's estimate of the project quality, y_C, and also in the investors' estimate of the project quality, $y_M(D_1)$, because a higher perceived project quality enables the firm to get better terms on external financing. The CEO's dividend decision at date 1 maximizes the total payoff to the original shareholders: the dividend payout D_1 and their stake in the firm as given by (2). Thus, conditional on investment at date 2, the CEO chooses D_1, $0 \leqslant D_1 \leqslant C_0 - I_1$, to maximize his expectation of the payoff to the original shareholders:

$$Z \equiv D_1 + y_C f(I) - \frac{y_C}{y_M(D_1)}\{I - g(C_0 - I_1 - D_1) - X\}. \tag{3}$$

2.5. Investment policy

The CEO's investment decision is based on a comparison of (3) with the following payoff to shareholders when the firm does not invest at date 2:

$$C_0 - I_1 + X. \tag{4}$$

Note that the CEO's overconfidence C and the private signal s enter the CEO's problem in (3) and (4) only through the CEO's estimate of project quality y_C. Consider a value of y_C such that the CEO invests at date 2. This requires that (3) exceed (4). Since the dividend $D_1 \leqslant C_0 - I_1$ in (3) is less than the payoff in (4), the coefficient of y_c must be positive in (3). Then, (3) continues to exceed (4) for even higher values of y_C. Thus, the CEO invests at date 2 precisely if his estimate of project quality y_C exceeds a threshold $\bar{y}_C$.

2.6. Dividend policy

Now, we characterize equilibrium dividend policy. The dividend decision depends on the cost of retaining cash, the investment need at date 2, and the perceived cost of date 2 external financing, which in turn depends on the perceived underpricing of equity. The equilibrium must be such that if the CEO estimates project quality y_C to be less than $\bar{y}_C$, he pays out a maximum dividend of $D_1 = C_0 - I_1$ to bring cash balance C_1 to zero at date 1 and shuns investment at date 2. If on the other hand, $y_C > \bar{y}_C$, the CEO pays dividend $D_1 = h(y_C) \leqslant C_0 - I_1$ and invests at date 2. On observing less than the maximum dividend, investors infer expected project quality as

$$y_M(D_1) = E[y|h(y_C) = D_1]. \tag{5}$$

There exists a unique reactive equilibrium as defined in Riley (1979). A reactive equilibrium is a pair of the CEO's dividend policy $D_1 = h(y_C)$ and the market's pricing function $y_M(D_1)$ such that (i) D_1 maximizes the CEO's objective (3) taking $y_M(D_1)$ into account and (ii) $y_M(D_1)$ is the expected value of the project quality y given equilibrium dividend policy and D_1 (5). Moreover, this pair Pareto dominates any other pair satisfying these conditions. The model can be recast in the Riley (1979) setting as follows. The CEO is privately informed about y_C. The market's valuation of the firm's project is proportional to y but it knows neither y nor y_C. It observes the CEO's dividend choice D_1 and values the firm's project using y_M, its expectation of y. The CEO prefers that the market assign a higher valuation to the firm's project. He can use the dividend amount as a signal of the project quality.

[6] We do not consider debt financing. However, to the extent that the firm can raise riskless financing and that debt value is less sensitive to project quality, the firm may prefer debt financing to equity financing in accordance with Myers and Majluf (1984). This effect will be stronger for overconfident CEOs if they consider equity financing to be more costly, consistent with the evidence provided in Malmendier et al. (2011).

The conditions specified in Riley (1979) for the existence of a reactive equilibrium hold. We discuss two of these conditions here. First, reducing the dividend amount in order to signal a higher project quality is costly to the CEO (because of the dissipative cash storage cost) but is not costly to the market. Second, the CEO's cost-to-benefit ratio of signaling through a dividend reduction is decreasing in his estimate of project quality. This can be verified by taking partial derivatives of (3) with respect to D_1 and y_M. The marginal cost of paying a lower dividend, $\partial Z/\partial D_1 = 1 - g'(C_0 - I_1 - D_1)\frac{y_C}{y_M}$, is decreasing in y_C while the marginal benefit from a higher valuation by the market, $\partial Z/\partial y_M = \frac{y_C}{y_M^2}\{I - g(C_0 - I_1 - D_1) - X\}$, is increasing in y_C.

To show that the equilibrium dividend amount is non-increasing in project quality, consider the first-order condition for the equilibrium dividend level $D_1 = D^*$ that maximizes the CEO's objective in (3):

$$1 - \frac{y_C}{y_M(D^*)}\left[g'(C_0 - I_1 - D^*) - \frac{y'_M(D^*)}{y_M(D^*)}\{I - g(C_0 - I_1 - D^*) - X\}\right] = 0. \tag{6}$$

A CEO who estimates a higher project quality $\hat{y}_C > y_C$ prefers to pay a dividend lower than D^* at date 1 because his objective in (3) is decreasing in D_1 at $D_1 = D^*$. This is seen by recalculating the derivative in (6) with the CEO's project quality estimate $\hat{y}_C$:

$$1 - \frac{\hat{y}_C}{y_M(D^*)}\left[g'(C_0 - I_1 - D^*) - \frac{y'_M(D^*)}{y_M(D^*)}\{I - g(C_0 - I_1 - D^*) - X\}\right] < 0. \tag{7}$$

The inequality is obtained from (6) and $\hat{y}_C > y_C$. The intuition is that a CEO choosing less than the maximum dividend payout is trading off the benefit of higher payout to investors against the cost of reduced future payoff to investors. A CEO who estimates a higher project quality perceives the cost of dividend payout to be higher because he perceives the external financing that will be needed in the future following a larger dividend payout to be more costly due to equity undervaluation. Thus, a CEO with a higher estimate of project quality pays a lower dividend. A higher estimate of project quality, in turn, can result from a higher signal about the project quality or from higher CEO overconfidence. That is, the dividend payout will be lower if the CEO's signal reflects higher project quality or if the CEO is more overconfident.

We draw two main results from this analysis. First, a more overconfident CEO is more likely to invest in the project at date 2 than a less overconfident or rational CEO even when both observe the same signal. Second, conditional on investing in the project at date 2, the firm led by a more overconfident CEO pays a lower dividend at date 1 than a firm led by a less overconfident or rational CEO even if the two CEOs observe the same signal about the project quality. The reason for the overinvestment by the overconfident CEO is the overestimation of the project quality compared to a rational CEO. The reason for the lower dividend payout by the overconfident CEO is that the overconfident CEO perceives equity as more undervalued and hence external financing as more costly than does a rational CEO. Thus, while it is easy to see why an overconfident CEO may reduce dividend payout in order to increase current investment, we show that the reduction in dividend may also be motivated by a desire to build internal capital for future investment when external financing is perceived to be costly.

Malmendier et al. (2011) document that overconfident CEOs are less likely to raise external financing. This finding is consistent with our analysis in that the overconfident CEO overestimates the cost of external financing and plans to reduce future reliance on external financing by reducing the dividend payout.

2.7. Firm growth

The effect of overconfidence is stronger for new, private information and weaker for information that is widely held and accepted (see Daniel et al., 1998). A CEO's beliefs about some investment opportunities may be based on private information while for others, the CEO's beliefs may depend on widely available public information. CEO overconfidence has a greater impact in the former case than in the latter. To incorporate this feature of overconfidence, we now distinguish between two projects: (i) an innovative project, the previously discussed project that is evaluated by the CEO based on

private information (i.e., signal s) and (ii) a growth project that reflects growth opportunities of the firm, is publicly observed, and about which the CEO has no private information. With probability Q, the growth project is available and dominates the innovative project in quality regardless of the CEO's beliefs about the innovative project. With probability $1-Q$, the growth project is unavailable or is dominated by the innovative project. We interpret the parameter Q as firm growth.

When the growth project is available to the firm, both rational and overconfident CEOs invest in the growth project about which there is no difference of opinion and the CEOs pay identical dividends. This occurs with probability Q. Let D^g be the common dividend amount. With probability $1-Q$, the firm does not have access to the growth project, so the CEO's dividend decision is based on his beliefs about the innovative project. In this case, we have already established that a CEO's expected dividend $\overline{D}(C)$ is a decreasing function of his overconfidence C. The unconditional expected dividend is $\mathbb{E}[D_1] = QD^g + (1-Q)\overline{D}(C)$. While CEO overconfidence leads to a lower expected dividend ($\mathrm{d}\mathbb{E}[D_1]/\mathrm{d}C = (1-Q)\overline{D}' < 0$), the difference between a rational CEO's dividend and an overconfident CEO's dividend is decreasing in firm growth ($\mathrm{d}^2\mathbb{E}[D_1]/\mathrm{d}C\mathrm{d}Q = -\overline{D}' > 0$). Thus, the impact of CEO overconfidence on dividend payout diminishes in a higher growth firm because such a firm is more likely to exploit growth projects making the CEO's interpretation of his private information less relevant for corporate policies.

2.8. Overconfidence and the stock price response to changes in dividend policy

Allen and Michaely (2003) note that the market on average reacts positively to announcements of increases in dividends and negatively to announcements of dividend decreases. The most common explanation for this reaction is the signaling hypothesis – higher dividends are announced by managers to signal higher future cash flows. However, Allen and Michaely (2003) point out that there is little empirical evidence that higher earnings follow larger dividends. Thus, they conclude that if firms use dividends as a signal, the signal is not about future growth in earnings or cash flows. Our model suggests that dividends may convey information about CEO overconfidence. Since the CEO's dividend choice depends on his inference about the project quality y_C, the dividend announcement on date 1 reveals the CEO's inference to the market. This inference is based on the CEO's signal as well as his overconfidence, so the dividend is informative about the signal of project quality and about the CEO's overconfidence.

To see how investors react to a large dividend increase, consider a simple setting with two levels of dividend. Suppose the project quality y is equally likely to be low (y^L) or high ($y^H > y^L$). The CEO's overconfidence C is equally likely to be $1-\delta$ or $1+\delta$ where $\delta > 0$ indicates uncertainty about CEO's overconfidence. Recall $C = 1$ represents a rational CEO. If $C > 1$, the CEO may interpret a low-quality project to be high-quality with probability $\pi(C-1)$ where $\pi(0) = 0$ and π is an increasing function. Similarly, if $C < 1$, the CEO may interpret a high-quality project to be low-quality with probability $\pi(1-C)$. When investors observe a high dividend, they infer that the CEO interpreted the project to be low-quality and use Bayes' rule to calculate the posterior probability that the project is actually low-quality to be $1 - 0.5\pi(\delta)$.[7] The expected project quality equals $y^L + 0.5\pi(\delta)(y^H - y^L)$. Similarly, when investors observe a low dividend, they estimate expected project quality to be $y^H - 0.5\pi(\delta)(y^H - y^L)$. The share price sensitivity to the dividend increase is proportional to the difference of these two values, $-(y^H - y^L)(1 - \pi(\delta))$, and thus, increasing in the uncertainty δ about CEO overconfidence.[8] The intuition is that a higher dividend signals lower project quality and lower overconfidence. The extent to which the market updates its beliefs about either of these attributes is proportional to the uncertainty about that attribute.

[7] The joint probability that the project is low quality, CEO overconfidence is $1-\delta$, and the CEO interprets quality to be low, is $0.5 \times 0.5 \times 1$. The joint probability that the project is low-quality, CEO overconfidence is $1+\delta$, and the CEO interprets the quality to be low, is $0.5 \times 0.5 \times (1-\pi(\delta))$. The sum of these two joint probabilities, $0.5 \times (1 - 0.5\pi(\delta))$, is the probability that the project quality is low and CEO also infers it to be low. So when the CEO infers project quality to be low (which occurs with probability 0.5), the conditional probability that the quality is low is calculated using Bayes' rule as $0.5 \times (1 - 0.5\pi(\delta))/0.5 = 1 - 0.5\pi(\delta)$.

[8] The model does not explain the empirically-observed positive average stock price response to dividend increases. This may be because the model (i) assumes that firm value and CEO overconfidence are uncorrelated and (ii) does not consider other factors that may affect dividends.

When there is greater uncertainty about the CEO's overconfidence, a dividend increase results in a greater reduction in perceived CEO overconfidence and elicits a higher stock price response.

2.9. Testable hypotheses

For our empirical analysis, we derive and test the following three hypotheses from our model:

Hypothesis 1. Firms led by overconfident CEOs pay lower dividends than firms led by rational CEOs. This follows from Section 2.6.

Hypothesis 2. The difference between the dividend payments by a rational CEO and an overconfident CEO is smaller in a firm with higher growth (Q). This follows from Section 2.7.

Hypothesis 3. The sensitivity of the stock price response to a dividend increase announcement is increasing in the uncertainty about CEO overconfidence. This follows from Section 2.8.

3. Data and variables

3.1. Data

Our initial sample of firms is identical to that in Malmendier and Tate (2005, 2008), and in Malmendier et al. (2011), and is based on the sample of 477 firms in Hall and Liebman (1998) and in Yermack (1995). To be a part of this sample, a firm must appear at least four times in one of the lists of the largest US companies compiled by *Forbes* magazine over the period, 1984–1994. This data set provides detailed information on CEO stock and stock option holdings. The dynamics of the option grants and holdings provide a reasonably clear picture of how a CEO rebalances his or her portfolio over his/her tenure. Malmendier and Tate (2008) use the data on option holdings to derive their portfolio-based overconfidence measures.[9]

An overconfident CEO is overoptimistic about the expected value of the firm's future payoff. He perceives his firm's stock to be undervalued and is less likely to exercise stock options than his rational counterparts.[10] This is the rationale behind the portfolio-based overconfidence measures. Malmendier and Tate (2005, 2008) carefully explore alternative explanations for why CEOs may not exercise their options optimally. Their tests rule out taxes, board pressure, corporate governance, inside information, signaling, and inertia as potential explanations and strengthen the interpretation of their measures as proxies for overconfidence. They conclude that the relation between "late option exercise and mergers is most consistent with overconfidence." Malmendier and Tate (2005, 2008) also use data from articles about CEOs in the business press to derive alternative press-based overconfidence measures. We use their overconfidence measures in our analysis of dividend policy.

From the panel data on the original sample of 477 firms, we eliminate observations for financial firms (SIC 6000-6999), utilities (SIC 4900-4999), and regulated telephone companies (SIC 4813). Our data cover the period, 1980–1994. We supplement the above data on CEO overconfidence with various items from the COMPUSTAT database to construct our control variables. These data filters result in 2778 firm-year observations for 244 firms for our main empirical analysis.

[9] Option grants usually represent a large component of CEO compensation packages. These options cannot be traded and the firms prohibit CEOs from hedging this exposure via short-selling their company stock. In addition, CEOs have their human capital invested in the firm. These effects in unison cause CEOs to be underdiversified and highly exposed to firm-specific risk. If the options are sufficiently in-the-money, rational CEOs should exercise them well before the expiration date to reduce their underdiversification. But, overconfident CEOs may hold the options longer (than rational CEOs) if they believe that the benefits of leaving the options unexercised outweigh the costs of underdiversification. Malmendier and Tate use this rationale to derive portfolio-based CEO overconfidence measures based on the option-exercise behavior of CEOs. For further details on these CEO overconfidence measures, see Malmendier and Tate (2005, 2008) and Malmendier et al. (2011).

[10] If overconfidence manifests instead as underestimation of the volatility of the future payoff, the perceived reduction in the risk of option holdings by the underdiversified CEO increases the CEO's utility from holding on to the option.

3.2. Variables

The various measures of overconfidence that we use in our study are as follows:

Longholder: This indicator variable identifies CEOs who hold an option until the year of expiration at least once during their tenure even though the option is at least 40% in the money. Malmendier and Tate (2008) use the calibrated exercise threshold of 40% based on the model in Hall and Murphy (2002) and assume that a CEO has a constant relative risk-aversion of 3 and 67% of his or her wealth is in the company stock. The Longholder variable represents a fixed effect over all of a CEO's years.

The Longholder variable is a noisy measure of overconfidence. For example, a CEO is not classified as Longholder if his options are not 40% in the money. Thus, CEOs not classified as a Longholder may represent a mix of rational and overconfident CEOs. For ease of exposition, we refer to the CEOs in this group as rational CEOs. This noise in the Longholder variable introduces a bias against finding support for the hypothesized negative relation between dividends and CEO overconfidence.

Pre-/Post-Longholder: Pre-Longholder and Post-Longholder represent a split of the Longholder (indicator) variable. These two measures, also based on the CEO's option-exercise behavior, allow for time variation over the sample period and eliminate forward-looking information in the classification of a CEO. Post-Longholder equals one in all CEO-years following the first year in which the CEO holds an option until the last year of expiration, provided the option is at least 40% in-the-money. Pre-Longholder equals one for those CEO years where Longholder equals one and Post-Longholder equals zero.[11]

TOTALconfident: Malmendier and Tate (2008) collect data on articles about the CEOs in The New York Times, Business Week, Financial Times, The Economist, and The Wall Street Journal. For CEO i and sample year t, they compare the number of articles that refer to the CEO with the terms "confident" or "confidence" (a_{it}) and "optimistic" or "optimism" (b_{it}) to the number of articles that refer to the CEO as "not confident" (c_{it}) or "not optimistic" (d_{it}), and "reliable," "cautious," "conservative," "practical," "frugal," or "steady" (e_{it}). They use these data to construct the following press-based measure of overconfidence for CEO i in year t:

$$\text{TOTALconfident}_{it} = \begin{cases} 1 & \text{if } \sum_{s=1}^{t-1} a_{is} + b_{is} > \sum_{s=1}^{t-1} c_{is} + d_{is} + e_{is}, \\ 0 & \text{otherwise.} \end{cases}$$

As in Malmendier and Tate (2008), when we use TOTALconfident, we control for the total number of press mentions of a CEO (TOTALmentions) over the same period (i.e., over all the preceding sample years). The reason is that a press bias towards positive mentions might imply a positive association between press mentions of "confident" or "optimistic" *and* the total number of mentions.

The extant empirical literature on dividends indicates that dividend policy is strongly influenced by growth opportunities, cash flow, and firm size (Fama and French, 2001, 2002; Fenn and Liang, 2001; Smith and Watts, 1992). The overall evidence indicates that dividends are positively related to both firm size and cash flow and negatively related to growth opportunities. Fenn and Liang (2001) also document the importance of stock and option ownership in determining dividend policy. Asymmetric information problems can make managers reluctant to raise funds through external sources, which might lead to underinvestment (Myers and Majluf, 1984). One mechanism to control the underinvestment problem is to increase financial slack via a lower dividend payout (Fama and French, 2002). Therefore, the higher the level of asymmetric information, the lower the dividends. On the other hand, the signalling models in Bhattacharya (1979) and Miller and Rock (1985) imply a positive relation between the level of asymmetric information and dividends.

In our empirical analysis, we control for CEO stock ownership, CEO option ownership, growth opportunities, cash flow, firm size, and the level of asymmetric information.[12] The CEO's stock

[11] For robustness, we also use the Holder67 measure from Malmendier and Tate (2008) despite its lack of power. Only 40% of the observations where the Longholder equals 1 or 0 fall in the Holder67 category. In other words, we lose 60% of the observations when we use the Holder67 variable.

[12] We thank Ulrike Malmendier for providing us the data on both CEO stock ownership and CEO option ownership.

ownership, termed as *Stock Ownership*, equals the fraction of the company stock owned by the CEO and his immediate family as a fraction of common shares outstanding. The CEO's option ownership, termed as *Vested Options*, equals the ratio of the CEO's holdings of vested options, exercisable within six months, as a fraction of common shares outstanding. We use the natural logarithm of sales, termed as *Log of Sales*, as a proxy for firm size. For robustness, we also use the natural logarithm of the book value of assets.[13] We calculate *Growth* as the ratio of the market value of assets to book value of assets, where the market value of assets equals the market value of equity plus the book value of total assets minus the book value of equity[14]; *Cash Flow* as the ratio of operating income before depreciation to book value of assets (Fenn and Liang, 2001; Opler and Titman, 1993). We trim cash flow at 0.5% to ensure that our results are not affected by outliers (see Malmendier and Tate, 2005, 2008). We measure the level of asymmetric information with *Tangible Assets*, which equals the ratio of property, plant, and equipment to total assets. A higher level of *Tangible Assets* implies lower asymmetric information. We follow Fenn and Liang (2001) and calculate the *Dividend Payout*, our dependent variable, as the ratio of common stock dividends to the market value of equity. Our data indicate the presence of extremely large outliers for the dividend payout variable so we trim dividend payout at the 99.5% level. Our results from the cross-sectional analysis, however, are similar when we winsorize the data at the 99.5 percentile and the 0.5 percentile (where applicable). We also verify our results with two alternative measures of dividend payout calculated as the ratio of dividends to earnings and as the ratio of dividends to operating income before depreciation.

4. Empirical results

4.1. Cross-sectional analysis

First, we provide univariate comparisons between the subsample of firms with Longholder = 1 (overconfident CEOs) and that of firms with Longholder = 0 (rational CEOs and overconfident CEOs with options insufficiently deep in the money). Next, we perform a multivariate analysis by estimating a random-effects tobit model of dividend payout as a function of CEO overconfidence and the control variables discussed above.[15] By using a multivariate tobit analysis, we examine the marginal impact of CEO overconfidence on dividend policy while controlling for other relevant factors. We control for industry effects in all models.[16] We estimate the tobit model using those observations for which data are available on all variables.

The summary statistics in Table 1 show that Longholder CEOs represent about 21% of the observations. The dividend yield, our main variable of interest, is slightly lower for firms with Longholder (i.e., overconfident) CEOs. In addition, firms with Longholder CEOs have a higher CEO option ownership, a higher CEO tenure, and a higher mean value of TOTALconfident. The associations between Longholder and CEO option ownership/tenure are likely to arise mechanically given the construction of the Longholder measure. We control for these variables in our empirical analysis. The correlation between Longholder and TOTALconfident is 0.0542. Longholder represents a CEO fixed effect and assumes a fixed value of either 1 or 0 throughout the sample period. TOTALconfident can also assume a value of 1 or 0. However, this value can change every year and might explain the low correlation between Longholder and TOTALconfident over time.

Next, we estimate a random-effects tobit model of dividend payout on the panel data for our sample firms. The independent variables are stock ownership, vested options, Longholder, growth, cash

[13] The positive relation between size and dividend policy that is widely documented in the literature is consistent with several explanations. For instance, larger firms are viewed as having less asymmetric information and lower financing costs (see Fenn and Liang, 2001; Opler and Titman, 1993; Smith and Watts, 1992). In addition, larger firms are considered to have less volatile cash flows. Fama and French (2002) argue that firm size serves as a reasonable proxy for cash flow volatility, and firms with lower cash flow volatility are predicted to pay higher dividends (Fenn and Liang, 2001).

[14] See Fenn and Liang (2001); Opler and Titman (1993), and Smith and Watts (1992).

[15] We estimate a tobit model because the dependent variable (*Dividend Payout*) is left-censored at zero.

[16] We follow Malmendier and Tate (2008) and control for the following industries via indicator variables: Agricultural Production (SIC 100), Technical (SIC 1000-1799, 8711), Manufacturing ((SIC 2000-3999), Transportation (SIC 4000-4899), Trade (5000-5999), and Service (SIC 7000-8710, 8712-8720, 8722-8999).

Table 1
Summary statistics: Longholder CEO firms vs. Non-Longholder CEO firms.

Variable	Longholder CEOs			Non-Longholder CEOs			Longholder vs. Non-Longholder	
	Mean	Median	Standard deviation	Mean	Median	Standard deviation	*p*-value for difference (in Means)	*p*-value for difference (in Medians)
Dividends to market value of equity	0.0235	0.0234	0.02	0.026	0.024	0.02	0.008	0.146
Book value of assets (in $ billions)	3.4169	1.7613	5.71	3.9716	1.9031	6.61	0.066	0.373
Net sales (in $ billions)	3.8337	2.2121	4.89	4.4213	2.3451	6.38	0.040	0.426
Stock ownership	0.017	0.003	0.04	0.031	0.002	0.09	0.000	0.000
Vested options	0.080	0.021	0.27	0.017	0.005	0.04	0.000	0.000
Growth opportunities	1.755	1.456	1.03	1.629	1.314	1.01	0.009	0.000
Cash flow	0.180	0.171	0.09	0.160	0.154	0.08	0.000	0.000
Tangible assets	0.413	0.401	0.16	0.393	0.373	0.19	0.019	0.000
Leverage	0.214	0.208	0.13	0.237	0.223	0.15	0.001	0.044
CEO tenure (years)	10.83	9.00	7.20	8.35	6.00	7.61	0.000	0.000
TOTALconfident	0.2903	0.00	0.45	0.2341	0.00	0.42	0.009	NA[a]
Observations		574			2204			

Stock ownership is the ratio of total shares owned by the CEO and his immediate family to the number of shares outstanding. Vested options equals the CEO's ownership of options (exercisable within six months of the beginning of the year) as a fraction of shares outstanding. Longholder is a binary variable that equals 1 if the CEO held an option package until the last year before expiration at least once during his/her tenure *and* the option package held was at least 40% in the money entering its final year. Growth Opportunities equals the ratio of the market value of assets to book value of assets, where the market value of assets equals the market value of equity plus the book value of total assets minus the book value of equity. Cash Flow equals the ratio of operating income before depreciation to book value of assets. Tangible Assets equals the ratio of property, plant, and equipment to book value of assets. Leverage equals the ratio of long-term debt to book value of assets. CEO tenure is the tenure of the CEO (in years) with the firm. TOTALconfident is a binary variable that equals 1 when the number of "confident" and "optimistic" mentions for a CEO exceeds the number of "not confident", "not optimistic", and "reliable, cautious, practical, conservative, steady, frugal" mentions. We base the summary statistics on pooled observations (across firms and time) with available data for the variables. The *p*-value for the difference in means is based on a two-sample *t*-test with equal variances and the *p*-value for the difference in medians is based on a non-parametric test of the equality of medians.

[a] Given the binary nature of the variable TOTALconfident, a test of the equality of medians is not appropriate.

flow, log of sales, and tangible assets. The results from Model 1 in Table 2 indicate that the level of dividend payout is negatively related to Longholder, growth, stock ownership, and vested options. The coefficients on these independent variables are statistically significant at the 1% level. The results also indicate that the level of dividend payout is positively related to tangible assets and to cash flow. The coefficients on both variables are statistically significant at the 1% level. These results are consistent with previous evidence (see Fama and French, 2001, 2002; Fenn and Liang, 2001; Smith and Watts, 1992) . The positive coefficient on tangible assets indicates that firms with lower information asymmetry pay higher dividends. This finding is consistent with the implications of the Myers and Majluf (1984) model but inconsistent with the signalling models. Finally, the coefficient on log of sales is not statistically significant at conventional levels.

The negative coefficient on Longholder indicates that the level of dividend payout is negatively related to the level of CEO overconfidence and conforms to our main testable prediction (Hypothesis 1).[17] The magnitude of the coefficient on Longholder, representing the marginal effect of CEO overconfidence, is 0.0039, which is about one-sixth of the median dividend yield reported in Table 1. As an illustration of the economic significance of this coefficient, consider the mean dividend yield of 2.6% for the sub-sample of non-Longholder CEOs. It corresponds to an annual dividend of $2.60 for a stock priced at $100. The dividend of a similar firm led by a Longholder CEO, on average, will be about 39 cents lower at $2.21.

[17] We also estimate a model with the Holder67 variable as a measure of CEO overconfidence. As suspected, the coefficient on Holder67, though negative, is not significantly different from zero with a *p*-value of 0.245 (see footnote 11).

Table 2
Does CEO overconfidence affect dividend payout?

Variable	Model 1 Coefficient (*z* value)	Model 2 Coefficient (*z* value)	Model 3 Coefficient (*z* value)	Model 4 Coefficient (*z* value)
Constant	0.0191	0.0140	0.0152	0.0101
	(1.62)	(1.18)	(1.29)	(0.85)
Stock ownership	−0.0325	−0.0326	−0.0309	−0.0315
	(−5.86)***	(−5.88)***	(−5.51)***	(−5.63)***
Vested options	−0.0256	−0.0253	−0.0237	−0.0235
	(−3.59)***	(−3.57)***	(−3.36)***	(−3.34)***
Longholder	−0.0039		−0.0037	
	(−3.22)***		(−3.03)***	
Post-Longholder		−0.0068		−0.0068
		(−4.45)***		(−4.30)***
Pre-Longholder		−0.0026		−0.0025
		(−2.04)**		(−1.92)*
Growth	−0.0093	−0.0092	−0.0093	−0.0091
	(−17.92)***	(−17.50)***	(−17.83)***	(−17.41)***
Cash flow	0.0242	0.0231	0.0152	0.0139
	(3.81)***	(3.64)***	(2.27)**	(2.09)**
Log of sales	0.0005	0.0007	0.0009	0.0011
	(0.91)	(1.32)	(1.66)*	(2.06)**
Tangible assets	0.0205	0.0208	0.0219	0.0219
	(5.80)***	(5.90)***	(6.15)***	(6.18)***
CEO tenure			−0.00002	0.000009
			(−0.56)	(0.17)
Leverage			−0.0159	−0.0159
			(−4.83)***	(−4.85)***
Industry effects	Yes	Yes	Yes	Yes
Observations	2778	2778	2744	2744
Number of firms	244	244	242	242
Log likelihood	6465.99	6470.84	6440.14	6444.90
χ^2	474.92***	486.51***	496.93***	507.94***

This table provides estimates from a random-effects tobit model, which is estimated on the pooled data. The dependent variable equals the ratio of total dividends to market value of equity. Stock ownership is the ratio of total shares owned by the CEO and his immediate family to the number of shares outstanding. Vested options equals the CEO's ownership of options (exercisable within six months of the beginning of the year) as a fraction of the shares outstanding. Longholder is a binary variable that equals 1 if the CEO held an option package until the last year before expiration at least once during his/her tenure *and* the option package held was at least 40% in the money entering its final year. Post-Longholder is a binary variable that equals 1 for all CEO-years after the CEO, for the first time, holds the option package until expiration. Pre-Longholder is a binary variable that equals 1 for CEO-years where Post-Longholder equals 0 and Longholder equals 1. Growth equals the ratio of the market value of assets to the book value of assets, where the market value of assets equals the market value of equity plus the book value of total assets minus the book value of equity. Cash Flow equals the ratio of operating income before depreciation to book value of assets. Log of Sales equals the natural logarithm of sales. Tangible Assets equals the ratio of property, plant, and equipment to book value of assets. CEO tenure is the tenure of the CEO (in years) with the firm. Leverage equals the ratio of long-term debt to book value of assets. All models control for firm-level random effects and the standard errors are based on variance estimates given by the inverse of the negative Hessian (second derivative) matrix.

* Significant at the 0.10 level.
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

In Model 2, we use Pre- and Post-Longholder, in place of the Longholder variable. The overall results are qualitatively similar to those in Model 1. The coefficient on Post-Longholder, however, is of greater magnitude and has stronger statistical significance than that on the Pre-Longholder variable. The results from this refinement in our model specification suggest that the impact of overconfidence on dividend policy appears to be stronger after the CEO has exhibited overconfidence by delaying option exercise.

We control for CEO tenure and firm leverage in Models 3 and 4. The summary statistics in Table 1 indicate that Longholder CEOs have a longer average tenure with the firm, suggesting that the relation between Longholder and dividend payout may be driven by a relation between CEO tenure and

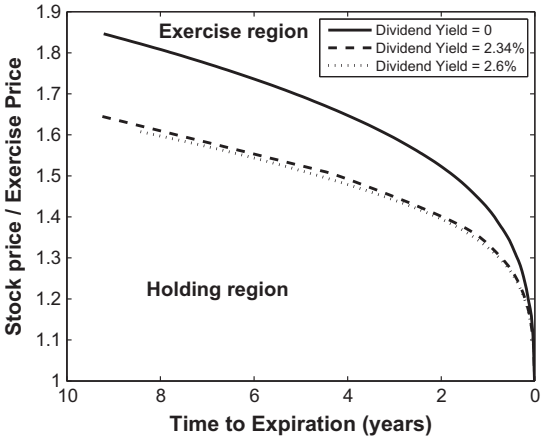

Fig. 2. Dividend yield and option exercise boundary.

dividend payout. Leverage has been documented to be negatively associated with dividends (Fama and French, 2002; Fenn and Liang, 2001), so we control for leverage even though it is not exogenous. We calculate leverage as the ratio of total long-term debt plus the amount of long-term debt in current liabilities to book value of assets. The results of the random-effects tobit model, presented in Model 3 of Table 2, indicate that the negative relation between Longholder and dividend payout is robust to the inclusion of both CEO tenure and leverage. The coefficient on CEO tenure is nonsignificant and suggests that CEO tenure has no effect on dividend policy. The negative and significant coefficient on leverage is consistent with the findings in Fama and French (2002) and in Fenn and Liang (2001). When we replace Longholder with Pre-Longholder and Post-Longholder, we obtain qualitatively similar results in Model 4.

4.1.1. Causality

An alternative explanation for the negative relation that we document between Longholder and dividend payout is that a lower dividend payout is associated with a smaller stock price decline, which reduces the value of exercising stock options earlier. Therefore, the CEO of a firm with a lower dividend payout is more likely to delay option exercise and be identified as Longholder. This reverse-causality suggests that differences in dividend policy across firms are driven by an exogenous factor that is omitted from our empirical analysis and the CEO's option exercise behavior responds to the dividend policy. The following three reasons strongly suggest that our findings do not result from reverse causality.

First, Fig. 2 shows our estimation of optimal option exercise boundaries, based on the assumptions of Hall and Murphy (2002), for three cases: no dividends, dividend yield of 2.34% (the median for Longholder CEOs), and dividend yield of 2.6% (the mean for Non-Longholder CEOs).[18] There is little difference between the threshold moneyness for the latter two cases suggesting that the delayed option exercise of Longholder CEOs does not appear to be caused by a lower dividend payout.

Second, the results in Table 2 indicate that the magnitude of the coefficient on the Post-Longholder variable is about 2.6 times as large as that on the Pre-Longholder variable. Note that the Pre- and the Post-Longholder variables represent a split of the Longholder variable for a given firm across time. If the option-exercise behavior of CEOs is driven by the dividend payout of a firm, then there should not be such a systematic difference in the relation between overconfidence and dividend payout in the Pre- and Post-Longholder years.

[18] The replication is based on the assumptions used in Hall and Murphy (2002). The CEO is assumed to have 67% of his $5 million wealth invested in firm stock and has a constant relative risk aversion of 3. The risk-free rate is 6%, the market risk premium is 6.5%, and the stock price has a lognormal distribution with annual volatility of 30%.

Finally, we use an alternative measure of CEO overconfidence that is based on the characterization of the CEO by the press. We estimate a random-effects tobit model of dividend payout with TOTALconfident, the press-based measure of CEO overconfidence. The rest of the explanatory variables are the same as in Model 1, Table 2. The results under Model 1 in Table 3 indicate that the coefficient on TOTALconfident is negative and significant at the 1% level. Since press mentions of CEOs are unlikely to be affected by dividend policy, this result rules out reverse causality and suggests that our finding with respect to Longholder potentially represents the causal effect of CEO overconfidence on dividend policy. We also control for the total number of CEO mentions and find that our findings remain robust as documented in Model 2. We also control for CEO tenure and firm leverage in Models 3 and 4 and find that our results with respect to the relation between TOTALconfident and dividend payout remain qualitatively similar.

Table 3
CEO overconfidence and dividend payout: press measures of overconfidence.

Variable	Model 1 Coefficient (z value)	Model 2 Coefficient (z value)	Model 3 Coefficient (z value)	Model 4 Coefficient (z value)
Constant	−0.0272	−0.0277	−0.0263	−0.0255
	(−2.16)**	(−2.18)**	(−2.07)**	(−2.00)**
Stock ownership	−0.0262	−0.0261	−0.0239	−0.0240
	(−4.57)***	(−4.53)***	(−4.15)***	(−4.17)***
Vested options	−0.0330	−0.0329	−0.0297	−0.0298
	(−4.65)***	(−4.62)***	(−4.22)***	(−4.23)***
TOTALconfident	−0.0047	−0.0046	−0.0040	−0.0041
	(−5.56)***	(−5.43)***	(−4.77)***	(−4.79)***
TOTALmentions		−0.0000		0.0000
		(−0.34)		(0.46)
Growth	−0.0080	−0.0080	−0.0080	−0.0080
	(−14.94)***	(−14.91)***	(−14.83)***	(−14.84)***
Cash flow	0.0134	0.0132	0.0018	0.0020
	(1.99)**	(1.95)*	(0.26)	(0.29)
Log of sales	0.0027	0.0027	0.0029	0.0029
	(4.66)***	(4.66)***	(5.06)***	(4.94)***
Tangible assets	0.0184	0.0182	0.0201	0.0204
	(4.90)***	(4.83)***	(5.35)***	(5.37)***
CEO tenure			−0.0001	−0.0001
			(−2.00)**	(−2.05)**
Leverage			−0.0183	−0.0184
			(−5.41)***	(−5.42)***
Industry effects	Yes	Yes	Yes	Yes
Observations	2403	2403	2364	2364
Number of firms	245	245	241	241
Log Likelihood	5599.75	5599.80	5566.48	5566.59
χ^2	421.05***	421.21***	451.33***	451.47***

This table provides estimates from a random-effects tobit model, which is estimated on the pooled data. The dependent variable equals the ratio of total dividends to market value of equity. Stock ownership is the ratio of total shares owned by the CEO and his immediate family to the number of shares outstanding. Vested options equals the CEO's ownership of options (exercisable within six months of the beginning of the year) as a fraction of the shares outstanding. TOTALconfident is a binary variable that equals 1 when the number of "confident" and "optimistic" mentions for a CEO exceeds the number of "not confident", "not optimistic", and "reliable, cautious, practical, conservative, steady, frugal" mentions. TOTALmentions is the total number of articles mentioning the CEO in both searches. Both TOTALconfident and TOTALmentions are based on the articles in the sample period up to the previous year. Growth equals the ratio of the market value of assets to the book value of assets, where the market value of assets equals the market value of equity plus the book value of total assets minus the book value of equity. Cash Flow equals the ratio of operating income before depreciation to book value of assets. Log of Sales equals the natural logarithm of sales. Tangible Assets equals the ratio of property, plant, and equipment to book value of assets. CEO tenure is the tenure of the CEO (in years) with the firm. Leverage equals the ratio of long-term debt to book value of assets. All models control for firm-level random effects and the standard errors are based on variance estimates given by the inverse of the negative Hessian (second derivative) matrix.

* Significant at the 0.10 level.
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

4.1.2. Robustness checks

In untabulated analyses, we estimate a random-effects tobit model with an R&D intensity variable in place of the growth variable. We calculate R&D intensity as the ratio of R&D expenditures to book value of assets. However, R&D expenditures are available for only 60% of the observations. We again obtain a negative relation between dividend payout and Longholder in this specification.[19] We also employ an alternative measure of cash flow: operating income before depreciation less capital expenditures, scaled by the book value of assets (as in Fenn and Liang, 2001). Our result about the negative relation between dividend yield and Longholder continues to hold in this specification. This result is also robust to the inclusion of cash balances, to an alternative measure of size (logarithm of book value of assets), and to an alternative measure of growth, calculated as the annual percentage increase in assets (see Fama and French, 2002).

To ensure that our results with respect to dividend yield represent the impact of CEO overconfidence on dividends and not just its impact on equity value, we use two alternative measures of dividend payout. The first equals the ratio of dividends to earnings (i.e., income before extraordinary items). This measure represents the traditional dividend payout ratio. This measure has a negative value for many observations that have negative earnings. In addition, the much higher volatility of earnings (relative to dividends) causes this measure to assume some very large values. To obtain a meaningful estimate of the effect of CEO overconfidence on dividend policy, we drop those observations where the payout is either negative or greater than one (which corresponds to about the 95th percentile). The negative relation between dividend payout and the various measures of CEO overconfidence continues to hold with this measure of dividend payout. The second alternative measure of dividend payout equals the ratio of dividends to operating income before depreciation (i.e., EBITDA). We drop those observations where the payout is either negative or greater than the 99th percentile. Again, the negative relation between dividend payout and the various measures of CEO overconfidence continues to hold with this measure of dividend payout.

In all the models, a likelihood ratio test strongly rejects a tobit model on pooled data in favor of a random-effects specification. We test for collinearity by computing the variance inflation factors for the independent variables used in Model 1, Table 2. The highest value for the variance inflation factor is 1.72 with an average value of 1.20 across all the variables. The low value for the variance inflation factors indicates that collinearity is not a problem in our data.[20]

Our data indicate that the Longholder variable does not appear to be concentrated in either the earlier or the later part of our sample period. Therefore, it is unlikely that the Longholder variable acts as a proxy for a time effect. Nonetheless, we estimate all our models with year effects. We find that all our results with respect to the relation between CEO overconfidence and dividends replicate with the inclusion of year effects.[21]

We perform a test to show that the negative association between CEO overconfidence and dividends is not merely a replication of the positive association between CEO overconfidence and investment, documented in Malmendier and Tate (2005). We estimate the random effects Tobit model in Model 1, Table 2 by controlling for investment spending. We calculate investment spending as the ratio of the sum of capital expenditures and R&D expenditures to book value of assets. We set R&D expenditures to zero if it is missing. The negative relation between Longholder and dividends remains robust to the inclusion of investment spending.

[19] Our results remain the same when we set the value of R&D expenditures to zero when it is missing and include these observations in estimating the random-effects tobit model.

[20] Collinearity may be a problem if the largest variance inflation factor (VIF) is greater than ten and the mean of the VIFs (across all independent variables) is substantially larger than one. For further details, see Chatterjee et al. (2000).

[21] An option to cluster standard errors is not available for the random-effects tobit model. However, we do not expect clustering to affect our results as (i) our sample contains more firms than years and (ii) our results are robust to year effects. Even though an unconditional fixed-effects tobit provides biased estimates, we estimate a simple pooled Tobit model with both firm effects and year effects and cluster the standard errors by firm or alternatively by year. The coefficient on Longholder is negative and significant in both cases and its magnitude is very similar to the one reported in Table 2. An attempt to perform 2D clustering by both firm and year results in a variance-covariance matrix with some negative diagonal elements suggesting that clustering in more than one dimension is not needed (Cameron et al., 2006; Peterson, 2009) .

To isolate any independent effect of firm age or volatility of cash flows on dividend policy, we include firm age and volatility, calculated as the coefficient of variation of the firm's past operating cash flows, in our regression specification. Our unreported results show that the negative relation between CEO overconfidence and dividends is unchanged with these additional controls. Thus, our result that overconfident CEOs pay lower dividends cannot be explained by variation in firm characteristics such as age and cash flow volatility.

Superior past firm performance combined with self-attribution bias may cause a CEO to become overconfident. To ensure that the relation between CEO overconfidence and dividends does not manifest a relation between dividends and past firm performance, we estimate our models by controlling for past performance. The relation between dividends and various measures of overconfidence remains robust to the addition of lagged sales growth or lagged percentage change in the market value of equity. However, we cannot eliminate the possibility that both CEO overconfidence and dividends may be endogenously determined by some other omitted variable.

4.1.3. Total payout

We also examine the relation between total payout and CEO overconfidence. Following Allen and Michaely (2003), we calculate *TotalPayout* as the sum of dividends and share repurchases divided by the market value of equity.[22] We estimate a tobit model using TotalPayout as the dependent variable, with the independent variables the same as those in Model 1, Table 2. Our untabulated results indicate that the (negative) coefficient on the Longholder variable is not significantly different from zero. In a second tobit model, we replace Longholder with Pre- and Post-Longholder and again find the (negative) coefficients on Pre- and Post-Longholder are not significantly different from zero. Finally, we use the press-based measure, TotalConfident, as the measure of CEO overconfidence and find that its coefficient is negative and significant at the 5% level.

Finance literature suggests important differences between dividends and repurchases, which may lead to these weaker results. Firms rarely lower dividends. Thus, dividends represent a commitment by the firm to continue paying them in the future and, accordingly, tend to be paid out of permanent earnings. Repurchases, in contrast, are flexible and more volatile, and tend to be paid out of temporary cash flows (Jagannathan et al., 2000). In addition, firms appear to time repurchases in response to other considerations such as when the stock price is low and when there is a build-up of cash (see Allen and Michaely, 2003; Brav et al., 2005; Lie, 2000). The irregular nature of repurchases makes the total payout variable less predictable and more noisy than dividends alone. This basic difference may explain why results are weaker when we use total payout instead of dividend payout.

Another potential explanation for the weak relation between total payout and CEO overconfidence is based on an overconfident CEO's perception that the firm's shares are undervalued. This perception causes an overconfident CEO to avoid raising external financing and in extreme cases, may also result in the overconfident CEO engaging in greater share repurchase activity than a rational CEO. Our untabulated results, however, show that share repurchases (scaled by the market value of equity) by firms led by overconfident CEOs are not significantly higher than those by firms led by rational CEOs. We also examine the relation between CEO overconfidence and repurchases as a fraction of the sum of dividends and share repurchases. Again, none of the overconfidence measures is statistically significant in explaining the fraction paid out via a repurchase.

4.1.4. Interaction effects

Growth opportunities, cash flow, and firm size are three important factors that affect dividend policy (see Fama and French, 2001, 2002; Smith and Watts, 1992). Firm size is correlated with information asymmetry in that larger firms have less information asymmetry (Bhushan, 1989). Given these findings, we examine how the relations between dividend payout and growth, cash flow, and the level of asymmetric information are influenced by CEO overconfidence using the Longholder measure.

[22] Share repurchases equal the value of the purchase of common and preferred stock (compustat data item 115) minus any reduction in the redemption value of preferred stock (compustat data item 56).

4.1.4.1. Growth. Hypothesis 2 predicts that the reduction in the dividend associated with CEO overconfidence is mitigated in firms with higher growth opportunities. The results in Model 1 in Table 4 are consistent with this hypothesis. The negative coefficients on growth and Longholder indicate that both higher growth and overconfidence are associated with a lower dividend payout. The coefficient on the interaction term between growth and Longholder is positive. These results indicate that regardless of whether the CEOs are rational or overconfident, a CEO in a higher-growth firm pays a smaller dividend than a similar CEO in a lower-growth firm. However, the difference in the dividend payout between higher-growth and lower-growth firms is smaller for overconfident CEOs than for rational CEOs. Stated equivalently, the decline in dividend payout caused by CEO overconfidence is larger for lower-growth firms than for higher-growth firms.

Table 4
CEO overconfidence and dividend payout: interactive effects of overconfidence with growth opportunities, cash flow, and asymmetric information.

Variable	Model 1 Coefficient (z value)	Model 2 Coefficient (z value)	Model 3 Coefficient (z value)
Constant	0.0211 (1.79)*	0.0206 (1.75)*	0.0200 (1.70)*
Stock ownership	−0.0327 (−5.91)***	−0.0324 (−5.85)***	−0.0327 (−5.90)***
Vested options	−0.0262 (−3.68)***	−0.0263 (−3.75)***	−0.0254 (−3.57)***
Longholder	−0.0101 (−5.34)***	−0.0111 (−4.92)***	−0.0055 (−3.44)***
Longholder * growth	0.0036 (4.25)***		
Longholder * cash flow		0.0405 (3.78)***	
Longholder * high tangible assets			0.0026 (1.51)
Growth opportunities	−0.0103 (−18.15)***	−0.0096 (−18.26)***	−0.0093 (−17.94)***
Cash flow	0.0229 (3.61)***	0.0176 (2.68)***	0.0239 (3.77)***
Log of sales	0.0005 (0.87)	0.0005 (0.88)	0.0005 (0.87)
Tangible assets	0.0208 (5.91)***	0.0210 (5.94)***	0.0194 (5.37)***
Industry effects	Yes	Yes	Yes
Observations	2778	2778	2778
Number of firms	244	244	244
Log Likelihood	6475.00	6473.14	6467.13
χ^2	493.81***	491.01***	477.61***

This table provides estimates from a random-effects tobit model, which is estimated on the pooled data. The dependent variable equals the ratio of total dividends to market value of equity. Stock Ownership is the ratio of total shares owned by the CEO and his immediate family to the number of shares outstanding. Vested options equals the CEO's ownership of options (exercisable within six months of the beginning of the year) as a fraction of shares outstanding. Longholder is a binary variable that equals 1 if the CEO held an option package until the last year before expiration at least once during his/her tenure *and* the option package held was at least 40% in the money entering its final year. Growth Opportunities equals the ratio of the market value of assets to the book value of assets, where the market value of assets equals the market value of equity plus the book value of total assets minus the book value of equity. Cash Flow equals the ratio of operating income before depreciation to book value of assets. Log of Sales equals the natural logarithm of sales. Tangible Assets equals the ratio of property, plant, and equipment (PPE) to book value of assets. High Tangible Assets equals 1 if Tangible Assets is greater than its sample median value and 0 otherwise. CEO tenure is the tenure of the CEO (in years) with the firm. Leverage equals the ratio of long-term debt to book value of assets. All models control for firm-level random effects and the standard errors are based on variance estimates given by the inverse of the negative Hessian (second derivative) matrix.

* Significant at the 0.10 level.
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

4.1.4.2. Cash flow. The finding that dividend payout is positively related to cash flow suggests that current cash flow serves as a signal of future cash flow. Following an increase in current cash flow, a CEO anticipates higher future cash flow, perceives a lower need for external financing, and increases the dividend payout. Our results from Model 2 in Table 4 indicate that the positive relation between dividend payout and cash flow is stronger for firms with overconfident CEOs. An explanation for this result is that an overconfident CEO perceives the current cash flow as a stronger predictor of future cash flow than does a rational CEO. This perception may arise from the following two mechanisms. First, suppose an overconfident CEO's estimate of future cash flow from assets in place is biased upward relative to a rational CEO. A higher current cash flow indicates that future cash flow from assets in place will represent a larger fraction of firm value, magnifying the effect of an overconfident CEO's bias in estimating this cash flow. Second, an overconfident CEO may overestimate the precision of current cash flow as a signal of future cash flow resulting in overreaction to current cash flow. Both mechanisms suggest that for a given increase in current cash flow, an overconfident CEO will increase the dividend payout more than a rational CEO.

4.1.4.3. Asymmetric information. Information asymmetry can cause external funds to be more costly than internal funds and make managers reluctant to raise external financing leading to underinvestment (Myers and Majluf, 1984). One mechanism to control the underinvestment problem is to increase financial slack via a lower dividend payout (Fama and French, 2002). This rationale suggests that dividends should be negatively related to the level of information asymmetry. We control for information asymmetry with tangible assets as higher tangible assets are likely to be associated with lower information asymmetry. The strong positive relation that we find between dividends and tangible assets is consistent with a negative relation between dividends and information asymmetry.

If overconfident CEOs anticipate a greater need for financing future investment than rational CEOs, then they will estimate a higher cost of underinvestment due to information asymmetry. The negative relation between information asymmetry and dividend payout should then be stronger for firms managed by overconfident CEOs. To test this prediction, we include the interaction between Longholder and tangible assets in explaining dividend yield. Our untabulated results indicate that neither the coefficient on Longholder, nor the coefficient on the interactive variable is significantly different from zero. The statistical nonsignificance of both variables may be caused by the high coefficient of correlation (0.91) between them. To shed light on this issue, we create an indicator variable, *High Tangible Assets*, that equals one if *Tangible Assets* is greater than its sample median value and zero otherwise and interact it with Longholder in Model 3 in Table 4. The coefficient on Longholder is negative and significant while that on the interactive variable is positive but not significant ($p = 0.13$). These results suggest that although information asymmetry has a negative effect on dividend payout, the strength of this effect does not appear to depend on CEO overconfidence for our sample firms.

4.2. Dividend changes: analysis of stock market effects

We use a standard market-model methodology to measure the impact of dividend-increase announcements on the stock price of announcing firms.[23] To enhance the likelihood of a notable unexpected component in the announcements, we only include announcements of dividend increases of at least 10%. The lower bound of 10% ensures that the dividend increase is economically significant. This approach is consistent with the extant body of research on dividend changes. For instance, Grullon et al. (2002) examine the frequency distribution of dividend changes and argue that the lower bound of 12.5% or 10% seems to be the best in terms of including big dividend changes. They also argue that dividend changes of at least 12.5% (or 10%) are likely to be categorized as surprises (or unexpected

[23] The empirical evidence on dividend policy suggests that dividend increases are significantly more frequent than dividend decreases as firms are usually reluctant to decrease dividends. Based on the data in Allen and Michaely (2003), the median annual number of dividend increases over the sample period of our study, i.e., between 1980 and 1994, is 1635 and the median annual number of dividend decreases is 95. Over this period, the minimum (maximum) number of dividend increases is 1072 (2513) and the minimum (maximum) number of dividend decreases is 59 (322). Given the paucity of data on dividend decreases, we focus on the sample of dividend increases.

changes) regardless of the underlying dividend expectation model. To the extent that our lower bound of 10% may also include dividend increases that are not unexpected, we introduce a bias against finding both statistically and economically significant relations between the stock-market response and the variables we use.

We identify 899 dividend-increase announcements from CRSP over our sample period, 1980–1994. We use data from CRSP to estimate the market-model parameters. The estimation period is 255 days and ends 46 trading days before the announcement date. We compute cumulative abnormal returns (CARs) over a three-day window that begins the day before and ends the day after the announcement date. We estimate a market model using the CRSP value-weighted index. The (untabulated) results from the market model indicate that both the mean and the median three-day cumulative abnormal return are significantly positive, consistent with previous findings.

As Section 2.8 suggests, an announcement of a dividend change provides information on both the project quality and the level of CEO overconfidence. A dividend-increase announcement conveys information that the project quality is poorer (implying a stock price decrease) and/or that the CEO is less overconfident implying lower overinvestment (and a higher stock price). One explanation of the positive average stock market response to dividend-increase announcements offered by our model is that these announcements may be more informative about CEO overconfidence than about investment opportunities.

Our objective, however, is to examine the relation between the uncertainty about CEO overconfidence and the stock-market response to dividend-increase announcements. Investors can ascribe overconfidence with a greater likelihood for Post-Longholder CEOs as they have been observed to hold options that are 40% or more in the money with less than a year to expiration. Investors cannot distinguish among overconfident and rational CEOs with much certainty if they have not been classified as Post-Longholder. Thus, the Post-Longholder variable is negatively related to uncertainty about CEO overconfidence.

We estimate a regression model in which the dependent variable is the three-day CAR based on the CRSP value-weighted index. The independent variables include stock ownership, vested options, Post-Longholder, growth, cash flow, log of sales, tangible assets, and the percentage increase in dividends. Given the strong and robust relation that we document between CEO overconfidence and the level of the dividend payout, it is conceivable that the sensitivity of the stock price response to the magnitude of the dividend increase differs between overconfident and rational CEOs. We allow for this possibility by including the product of Post-Longholder and the percentage increase in dividends as an independent variable in our regression model. Some firms in our sample make multiple announcements of a dividend increase in a given year. Announcements subsequent to the first one may differ from the first announcement in terms of incremental information and the consequent stock price response. We include a dummy variable (Multiple Ann) for announcements beyond the first announcement in a given year and also interact this variable with Post-Longholder in our regression model.

The results are reported in Table 5 and the t statistics are based on standard errors clustered by firm. The results in Model 1 indicate that the coefficient on Post-Longholder is negative and significant ($p = 0.03$). This finding is consistent with Hypothesis 3. That is, a dividend increase announcement in firms with Post-Longholder CEOs conveys relatively more information about (poorer) project quality while a dividend increase announcement in the other firms conveys relatively more information about the level of CEO overconfidence. Thus, the magnitude of the positive reaction to the dividend-increase announcement is lower for firms managed by Post-Longholder CEOs.[24] This result is robust to the inclusion of both industry and year effects ($p = 0.055$). For completeness, we also estimate another regression model by including Pre-Longholder. We do not expect the coefficient on Pre-Longholder to

[24] Note that the level of overconfidence is also higher for Post-Longholder CEOs. An alternative explanation of our result is that investors draw more negative inference about firm prospects following dividend increases by overconfident CEOs than by rational CEOs if overconfident CEOs are less likely to increase dividends. However, our model does not predict the stock price response to depend on the level of overconfidence. While the model shows that overconfident CEOs pay lower dividends than their rational counterparts, it does not predict whether the *changes* in dividends will be higher or lower for overconfident CEOs. We estimate a Probit model of dividend increase and a Tobit model of the magnitude of the percentage increase in the dividend. The results do not indicate that overconfident CEOs are less likely to increase dividends.

Table 5
Announcements of dividend increases: stock market effects and CEO overconfidence.

Variable	Model 1 Coefficient (*t*-statistic)	Model 2 Coefficient (*t*-statistic)
Constant	−0.0180	−0.0187
	(−0.80)	(−0.83)
Stock ownership	0.0334	0.0343
	(1.40)	(1.44)
Vested options	0.0522	0.0501
	(3.29)***	(2.90)***
Post-Longholder	−0.0127	−0.0125
	(−2.18)**	(−2.13)**
Pre-Longholder		0.0015
		(0.51)
Growth	0.0001	0.0002
	(0.10)	(0.13)
Cash flow	−0.0045	−0.0050
	(−0.21)	(−0.24)
Log of Sales	0.0010	0.0010
	(0.99)	(1.02)
Tangible assets	0.0020	0.0019
	(0.29)	(0.27)
Dividend increase	0.0064	0.0064
	(0.81)	(0.80)
Div. increase * Post-Longholder	0.0372	0.0372
	(1.33)	(1.33)
Multiple Ann	0.0046	0.0047
	(0.73)	(0.75)
Multiple Ann * Post-Longholder	0.0088	0.0086
	(0.62)	(0.61)
Observations	899	899
F	2.23	2.04
p-value	0.0146	0.0230
R^2	0.0157	0.0159

This table provides estimates from a regression model. The dependent variable equals the three-day cumulative abnormal return associated with the announcement of a dividend increase of at least 10%. The sample contains 899 dividend-increase announcements. Stock ownership is the ratio of total shares owned by the CEO and his immediate family to the number of shares outstanding. Vested options equals the CEO's ownership of options (exercisable within six months of the beginning of the year) as a fraction of shares outstanding. Post-Longholder is a binary variable that equals 1 for all CEO-years after the CEO, for the first time, holds the option package until expiration. Pre-Longholder is a binary variable that equals 1 for CEO-years where Post-Longholder equals 0 and Longholder equals 1. Longholder is a binary variable that equals 1 if the CEO held an option package until the last year before expiration at least once during his/her tenure *and* the option package held was at least 40% in the money entering its final year. Growth equals the ratio of the market value of assets to the book value of assets, where the market value of assets equals the market value of equity plus the book value of total assets minus the book value of equity. Cash flow equals the ratio of operating income before depreciation to book value of assets. Log of sales equals the natural logarithm of sales. Tangible assets equals the ratio of property, plant, and equipment to book value of assets. Dividend increase is the percentage increase in the dividend from the preceding period. Multiple Ann is an indicator variable that equals one for announcements beyond the first one in a given year. The '*t*' statistic (in parentheses) is based on standard errors clustered by firm.

* Significant at the 0.10 level.

** Significant at the 0.05 level.

*** Significant at the 0.01 level.

be significant as investors cannot distinguish between a Longholder and a non-Longholder in the Pre-Longholder years of the overconfident CEO. The rest of the independent variables are the same as those in Model 1. The results in Model 2 indicate that the coefficient on Post-Longholder is negative and significant ($p = 0.035$) while the coefficient on Pre-Longholder is non-significant. CEO tenure may impact investors' expectations of a dividend increase and the stock price response to a dividend increase. We

find that our result with respect to Post-Longholder in Model 1 is robust to inclusion of CEO tenure as a control variable, whose coefficient is negative but not significant.[25]

In Models 1 and 2, we compare the stock price response in the Post-Longholder years to that for the rest of the observations. The comparison group comprises both non-Longholder CEOs and Longholder CEOs in their Pre-Longholder years. We also test Hypothesis 3 by focusing only on Longholder CEOs (Longholder = 1). For a Longholder CEO, the uncertainty about CEO overconfidence should be lower in Post-Longholder years than in the Pre-Longholder years. We estimate another regression model by restricting our sample to announcements made by Longholder CEOs in their Pre-Longholder or Post-Longholder years. This screen reduces the sample size by about 80%. Our results, however, do not change qualitatively and the magnitude of the stock price increase is smaller for Post-Longholder CEOs ($p = 0.068$). Our results are qualitatively similar when we exclude observations where Pre-Longholder = 1. In other words, we restrict our sample to observations with Post-Longholder = 1 or with Longholder = 0 and find that the coefficient on Post-Longholder is negative and significant ($p = 0.03$).

In Table 5, we document that the magnitude of the positive reaction to the dividend-increase announcement is lower for firms managed by Post-Longholder CEOs. However, the positive coefficients on interactive terms suggest that this difference in the stock price response is mitigated when the dividend increase is very large or when a firm announces multiple large dividend increases in a year. Very large or multiple large dividend increases in a year represent extreme events that may cause investors to reassess the level of CEO overconfidence, regardless of whether the CEO is a Post-Longholder. When we test Hypothesis 3 in Table 5, we assume that there is less uncertainty about overconfidence of Post-Longholder CEOs and hence there is little revision of beliefs about overconfidence when these CEOs increase dividends. However, the Post-Longholder variable is a noisy measure of overconfidence. Therefore, a very large dividend increase may result in a revision of investors' beliefs about CEO overconfidence and may explain the smaller differential in the stock price response (between Post-Longholder and other CEOs) for very large dividend increases.

We identify such events with an indicator variable that equals one for dividend increases greater than 50% (representing the 95th percentile) or for multiple dividend increases by a firm in a year. We estimate the model in Table 5 by including this variable and its interaction with Post-Longholder as independent variables along with stock ownership, vested options, Post-Longholder, growth, cash flow, log of sales, and tangible assets. The coefficient on Post-Longholder is negative and statistically significant at the 10% level ($p = 0.077$), confirming that the stock price response to dividend increases, which are not extreme, is smaller for firms with less uncertainty about CEO overconfidence.

5. Conclusion

We model dividend policy as a trade-off between reducing the cost of retaining excess cash and reducing the endogenous cost of external financing for future investment when the CEO acts in the interest of existing shareholders. Overconfident CEOs, who believe that the firm is undervalued and perceive external financing to be more costly relative to rational CEOs, pay lower dividends in order to accumulate greater financial slack for future investment needs. The model yields several testable predictions that we examine empirically. The main testable prediction is that an overconfident CEO pays a lower level of dividends relative to a rational CEO. Our model also predicts the difference in the dividend payout between higher- and lower-growth firms to be smaller in firms managed by overconfident CEOs. Another prediction is that the stock price response to announcements of dividend changes is an increasing function of the uncertainty about CEO overconfidence. We test these predictions and perform related empirical tests, using a panel data of large US companies. We use the measures of CEO overconfidence used in Malmendier and Tate (2005, 2008) and in Malmendier et al. (2011).

Consistent with our main prediction, we find that the level of dividend payout is lower in firms managed by overconfident CEOs. The reduction in dividend payout associated with CEO overconfi-

[25] The decision to increase dividends may depend systematically on firm-specific attributes. To control for a potential selection bias, we also estimate a model with Heckman correction and find that the stock-market response to dividend-increase announcements is lower for Post-Longholder CEOs ($p = 0.022$).

dence is both statistically and economically significant. Next, we document that the difference in the dividend payout between higher-growth and lower-growth firms is smaller for firms with overconfident CEOs. This finding is consistent with the prediction of our model that the reduction in dividend payout caused by CEO overconfidence is smaller in higher-growth firms. We further document that the positive relation between dividend payout and cash flow is stronger in firms with overconfident CEOs.

Finally, we analyze market perceptions about the relation between CEO overconfidence and dividend policy by examining the stock price response to announcements of dividend increases by our sample firms. We find that the magnitude of the positive stock price response to announcements of dividend increases is higher in firms in which there is greater uncertainty about the level of CEO's overconfidence. This finding is consistent with our hypothesis that dividends provide information about CEO overconfidence. Specifically, dividend increases indicate lower CEO overconfidence and that this inference is stronger when there is greater uncertainty about CEO overconfidence. Our empirical evidence collectively suggests that CEO overconfidence has a significant effect on dividend policy.

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