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Flexibility and dividends

Benjamin M. Blau [a], Kathleen P. Fuller [b,*]

[a] 320 Holman Hall, Department of Finance, School of Business, University of Mississippi, University, MS 38677, United States
[b] 321 Holman Hall, Department of Finance, School of Business, University of Mississippi, University, MS 38677, United States

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ABSTRACT

We develop a model of corporate dividend policy based on the idea that management values operating flexibility. By reducing dividends and conserving cash, management increases its flexibility. This improves its ability to invest in projects that it believes are good for the shareholders in the long run but which shareholders would not provide the capital for because they think the projects are value reducing. However, the cost of not paying dividends is a reduction in the current stock price. Management trades off these two aspects of dividends. Flexibility considerations help us understand various dimensions of dividend policy that existing theories do not explain. Our theory generates numerous testable predictions that we confront with the data. The evidence is supportive of the model.

1. Introduction

The notion that managers value financial flexibility is not new. Both Pinegar and Wilbricht (1989) and Graham and Harvey (2001) find that managers focus on financial flexibility when determining the firm's capital structure. Myers and Majluf (1984) suggest that having high cash balances are desirable to maximize the firm's financial flexibility. DeAngelo and DeAngelo (2006) model the capital structure choice as a trade off between controlling agency problems (Jensen, 1986) and providing financial flexibility to reduce investment distortions (Myers and Majluf). Since Jensen argues that debt is a substitute for dividends, a natural question arises: how does management's desire for flexibility affect the firm's dividend policy?

This paper addresses how a firm's dividend policy affects management's flexibility, and how dividend policy will be influenced by the flexibility tradeoffs perceived by management. At a very basic level, the flexibility-dividend link comes about because paying a dividend takes money out of management's control and puts it in the hands of investors. It can always be “retrieved” in the future via an equity issue, but not if investors disagree with management over the use of the funds. This way a dividend payment reduces management's flexibility.

We model the effect of flexibility by assuming that investors are skeptical about the potential profitability of projects managers present for investment. Investors may be skeptical about a project's profitability for several reasons. A project may benefit management personally at a cost of shareholder's wealth. In the case where management finds the investment opportunity to be personally beneficial, managers will be inclined to dress up the project when presenting it to shareholders. Shareholders will then form expectations about the project's payoff based on the potential for the investment to add value to the firm as well as the potential that management is dressing up the project. In the alternative case when management is presenting a project to shareholders in full information (i.e., managers are working in shareholders' best interest and the project will increase the firm's value), there may be situations when the information asymmetries influence shareholders to reject projects that may indeed be profitable. In recognition of such possible scenarios, management flexibility to make decisions it views as optimal even when

* Corresponding author. Tel.: +1 662 236 5463.
E-mail address: kpfuller@olemiss.edu (K.P. Fuller).

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investors do not agree will increase the value of the firm. This, in turn, will affect the decisions of management that will be driven by the desire to build up flexibility for *future* decisions.

There are numerous reasons why shareholders may overcompensate for the potential of management dressing up investment projects and reject profitable projects. One reason is that divergent beliefs may not converge because of non-uniform prior beliefs, with insufficient time for objective information to be exchanged for convergence to occur (Allen and Gale, 1999). Another reason is that the information being exchanged is “soft,” subjective or otherwise prone to different interpretations by different agents. Finally agents often rely heavily on their intuition and disagree because each agent has a different intuition about the optimal course of action (Clarke and Mackaness (2001)).[1] The precise reason why shareholders would overcompensate of the information asymmetries is irrelevant in our analysis. We take the possibility that management may indeed reject profitable investment projects because of this overcompensation as our starting point and consider situations in which those who disagree with management could block management's actions. We propose that in such circumstances, a firm's value will increase in the decision-making “elbow room” or flexibility that would permit management to overrule those who object. This means management will make decisions that *affect* this flexibility.

Shareholders recognize that agency costs may exist and prefer dividends so as to reduce the effect of the agency conflict. However, in the case that a profitable project comes along, shareholders will support management in undertaking the project. The firm has some cash on hand that management can keep within the firm to possibly finance a project. Alternatively, the cash can be paid out as a dividend.[2] The tradeoff management faces is as follows. On the one hand, if the cash is kept within the firm, management will have the flexibility to invest in the project in the future even though shareholders may think it is a bad idea. Moreover, no transactions costs will be incurred in raising external capital to finance the project. But not paying a dividend lowers the current stock price. On the other hand, if a dividend is paid, management will not be able to invest even in a project it believes is good if shareholders have to provide the investment capital and they think it is a bad project. Management's dividend policy strikes the optimal balance between these considerations.

We are motivated to examine managerial flexibility and dividends because ever since Miller and Modigliani (1961) hypothesized dividend irrelevance, why and how firms pay dividends remains a puzzle. First, our existing theories also do not help us understand why some firms never pay dividends whereas others consistently pay dividends. For example, Cisco and Microsoft have for years operated with no dividend payout and significant excess liquidity, while Wal-Mart and General Electric have had a long history of paying dividends while still maintaining high growth. It seems odd that Cisco and Microsoft would have nothing to signal and/or would not be concerned about perquisite consumption yet Wal-Mart and General Electric would. Further, Baker and Wurgler (2004) find that managers initiate dividends when investors place a premium on dividend-paying stocks and omit dividends when investors prefer non-dividend paying stocks. This suggests that managers are making dividend decisions based not only on the characteristics of their firms but also on their stock prices.

Second, empirical evidence is not overwhelmingly supportive for either of the two dominant theories of why firms pay dividends: signaling and free cash flow. The dividend-signaling hypothesis suggests managers with better information than the market will signal this private information using dividends. Bhattacharya (1979), John and Williams (1985), and Miller and Rock (1985) develop signaling models in which either taxes or distress borrowing costs create a dissipative cost that makes dividends a credible signal. Yet, the empirical support for signaling is mixed. While the price reaction following dividend change announcements have the same signs as the dividend changes and the magnitude of the price reaction is proportional to the magnitude of the dividend change[3], Benartzi et al. (1997) find that the relation between dividend changes and subsequent earnings changes are inconsistent with the theory; it appears that dividends are related more strongly to *past* earnings than future earnings. DeAngelo et al. (2006) find that firms that should have the greatest need to signal (i.e., pay dividends), firms with low earned/contributed equity, are the ones not signaling. Denis and Osobov (in press) find that the propensity to pay dividends is decreasing internationally and that large, profitable firms continue to pay dividends, which is inconsistent with signaling theories. However, Nissam and Ziv (2001) find that after controlling for measurement error and omitted correlated variables, dividend policy changes are positively associated with earnings changes in the two years following the dividend change, which suggests that dividend predict future earning opportunities for firms.

The free-cash-flow hypothesis suggests that since managers cannot credibly precommit to shareholders that they will not invest excess cash in negative-NPV projects, dividend changes may convey information about how the firm will *use* future cash flows. Easterbrook (1984), Jensen (1986), and Lang and Litzenberger (1989) all suggest that increasing dividends ensures that there is less free cash flow available to be wasted on inefficient projects, perks, and the like. Allen and Michaely (2003) discuss similarly mixed evidence about the free-cash-flow (FCF) hypothesis. In support of the FCF hypothesis, Grullon et al. (2002) find that firms anticipating declining investment opportunities are likely to increase dividends, and Lie (2000) finds that firms that increased dividends had cash in excess of that held by peer firms in the industry. However, Yoon and Starks (1995) found a symmetric price reaction to dividend changes across high-Tobin's Q and low-Tobin's Q firms, which goes against the FCF hypothesis. The somewhat inconclusive nature of the evidence makes it hard to pick a definite winner.

[1] Boot and Thakor (2003) provide an extensive discussion of the many different strands of literatures in economics and psychology that explain the various reasons why people disagree.

[2] The model could easily adapt to include stock repurchase programs since repurchasing shares would also reduce flexibility. However, stock repurchase plans are often discretionary and are not observable by investors, as noted by Howe, He and Kao (1992). Thus, these plans have a different signaling ability than regular dividend payments. Further, repurchases may be a “one-time-only” payout mechanism, while dividends are often viewed as a consistent future payout mechanism. This consistent payout enforces a reduction in flexibility over time where stock repurchases may not.

[3] See Allen and Michaely (2003) for a comprehensive survey of studies examining stock prices reactions to dividend changes.

Our model suggests that there may be a brighter side to FCF. While research typically argues that FCF will be used to finance unprofitable projects, we have discussed cases where having FCF results in more management flexibility and allows management to invest in profitable projects when shareholders are not convinced that these projects are wealth maximizing. We believe that flexibility considerations may well represent an important missing piece of the puzzle in understanding dividend policy. Our theory generates several predictions that we take to the data. We propose that dividend payments will be negatively correlated with stock prices, and investors will value dividends more when prices are lower. We do find that dividend levels are significantly higher when stock prices are lower and that dividends are more valuable to investors when stock prices are lower. We also predict that as the risk of the investment increases, the dividend payment decreases and that there will be a positive correlation between the firm's stock price and its idiosyncratic risk. The latter arises in our model from the endogenous dependence of dividends on stock prices and the endogenous link between the firm's idiosyncratic risk and dividend policy. Both of these predictions are also supported by the data.

In order to isolate management flexibility when the firm's dividend policy is determined, our model assumes that the firm is all equity financed; however, we recognize that firms will carry debt. Therefore, we look at a final set of predictions relating to the debt–equity ratio and liquidity of the firm. We hypothesize those firms with low debt-to-equity ratios will have lower dividend payments and find significantly lower dividends for firms with low debt-to-equity ratios.[4] Finally, we propose firms that have lower dividend payments will have higher levels of liquidity. In our model firms keep cash in the firm but do not waste it or consume it. Thus, any excess cash is kept to invest in future projects. Indeed firms with the highest levels of liquidity pay significantly less in dividends than firms with less liquidity. This is consistent with DeAngelo et al. (2006) that show firms are less likely to pay dividends if they have high cash balances.

Our empirical findings suggest that FCF can be advantageous to the wealth of shareholders. As Jensen (1986) argues, debt is a substitute for dividends and reduces agency costs. However, we find that firms that carry the lowest amount of debt pay the lowest dividend. Our explanation is that firms with the lowest levels of debt likely value flexibility and, therefore, do not make large dividend payments. This explanation is consistent with the financial flexibility arguments of DeAngelo and DeAngelo (2006). Similarly, firms with more cash tend to pay the lowest dividends. We argue that the empirical findings support the notion that FCF can be advantageous in the form of flexibility.

Our paper is closely related to DeAngelo and DeAngelo (2006). They present a model wherein a firm's capital structure decisions are based on the cultivation of financial flexibility. When the debt level exceeds the optimal target level, the firm becomes restricted in pursuing future profitable investments. The firm's choice of equity payouts directly impact the firm's capital structure choice as the dividends reduce the ability to invest in profitable projects. Our analysis is similar to DeAngelo and DeAngelo as we both assume that paying dividends will reduce management's flexibility. However, we use the concept of flexibility to explain why dividends are paid, while DeAngelo and DeAngelo apply the idea of flexibility to explaining capital structure. Our paper is also related to Jagannathan et al. (2000) who find that stock repurchases are pro-cyclical while dividends steadily increase over time. Further, firms increase dividends following good performance while stock repurchases are used following poor performance. The authors interpret their results to be consistent with the idea that repurchases “preserve financial flexibility relative to dividends because they do not implicitly commit the firm to future payouts (pg. 563).” Similarly, in our paper those firms that do commit to pay dividends reduce their future financial flexibility, although our notion of flexibility is different from theirs. Lie (2005) also finds that firms pay special dividends or repurchase shares when temporary excess financial flexibility (excess cash and lower than optimal debt levels) exists. DeAngelo et al. (2006) and Denis and Osobov (in press) both find that dividend payments reflect a lifecycle theory that incorporates some of the ideas of financial flexibility.

The remainder of the paper is organized as follows. Section 2 presents the theoretical model and Section 3 contains the analysis. Section 4 summarizes the empirical predictions of the model. Section 5 describes the data, empirical tests and results. Section 6 concludes.

2. The model

We begin by assuming that there are three points in time and all agents are risk neutral. At $t=0$, the firm, which is all equity financed, has existing assets in place that have both systematic and idiosyncratic risks.[5] With universal risk neutrality, the distinction between these two types of risk is irrelevant for valuation. However, this distinction is useful when we discuss the empirical predictions of our model and later when we take these predictions to the data. At $t=0$, the firm's assets in place have an expected value of V at $t=2$ that everybody agrees on. Moreover, the firm has cash in the amount of R at $t=0$. This cash can be used in one of three ways: it can be paid out as a dividend at $t=0$, it can be used to invest in a new project at $t=1$, or it can be carried over until $t=2$ and distributed as a liquidating dividend. Thus, the key decision at $t=0$ is whether or not to pay a divided.

It is known at $t=0$ that a new investment opportunity is going to arrive at $t=1$ that will require financing. Management may view this opportunity as wealth maximizing. However, there are occasions in which management may be self interested in the opportunity, in which, they desire to undertake the investment. In either case management can finance the project using cash it carried over from $t=0$ or, if this cash was paid out as a dividend at $t=0$, then by raising funds in the market at $t=1$. In the case where management finds the investment opportunity to be wealth maximizing, there are no agency costs of FCF. In the latter case, self-

[4] This relies on the fact that equity is typically more flexible than debt.

[5] We recognize that by assuming that a firm is all equity financed, our model is not fully representative of the real world. However, because debt and dividends are endogenous in determining the amount of free cash flow, the model's predictions are less tractable because debt and dividends are likely used simultaneously to reduce the agency costs of free cash flow.

interested managers may chose to undertake the project wherein the agency costs of FCF are defined as in previous research [e.g. Jensen (1986)]. We also assume that investing in the project will increase the firm's idiosyncratic risk. Given universal risk neutrality, this assumption will not affect any of our formal analysis, but will matter when we interpret the model for the empirical tests.

If a dividend is paid at $t=0$, then self-interested managers may or may not attempt to dress up the project when it is presented to shareholders. Shareholders recognize that asymmetric information exists and are therefore, skeptical about management's expectations for the project. All payoffs are realized at $t=2$. The corporate income tax rate is zero, as is the riskless rate of interest. Thus, there is no discounting of payoffs.

Project investments and payoffs and the dividend decision: As indicated earlier, at $t=0$, the firm has cash of R and assets in place that will have a value at $t=2$ whose expectation at earlier points in time is V. The firm's manager must decide at $t=0$ the size of the divided, D, to be paid to shareholders at $t=0$. For simplicity, we assume $D\in\{0, R\}$.

At $t=1$, a new project arrives and requires an investment of R. The payoff is a random amount ξ at $t=2$.[6] We assume that $\xi\in\{L, H\}$, where $0<L<R<H<\infty$. Thus, the project is worth investing in if the payoff is H, but not if it is L.

Whether the firm will have internal liquidity available to finance the project at $t=1$ depends on its dividend decision at $t=0$. If $D=0$ was chosen at $t=0$, the project will be financed out of the firm's internal liquidity. If $D=R$ was chosen at $t=0$, then the firm will raise \$$R$ from investors at $t=1$. We assume that doing so incurs a transaction cost of $\tau>0$.

Disagreement over future payoffs: Everybody agrees that the firm has R in cash at $t=0$ and that the assets in place at $t=0$ have an expected value of V at $t=2$. When the new project becomes available at $t=1$, management forms an expectation about its payoff at $t=2$, $E_m[\xi]$. Management's expected payoff may not always be wealth maximizing. That is, $E_m[\xi]$ is made up from a component that is wealth maximizing as well as a component that is self-interested. We let δ^* represent the true amount of management's expectation that is “dressed up”. If $E_m[\xi]+\delta^*=H$, it does not necessarily mean that $E_m[\xi]>R$ but instead management finds that the project can be personally beneficial. If $E_m[\xi]+\delta^*=H$, then management will move the project forward for investors to see. Investors will form their own expectation based on the $E_m[\xi]$ as well as the notion that management may also be “dressing up” the project. The (collective) investors will form an expectation, $E_s[\xi]\in\{L, H\}$. Here, investors are only concerned with the wealth of the firm. If $E_s[\xi]=H$, then $E_s[\xi]>R$.

We assume that $E_s[\xi]=E_m[\xi]+\delta$, where δ is the amount of management's expectation that shareholders *believe* is “dressed up”. So, shareholders will desire to undertake the project when $E_m[\xi]+\delta>R$. Because of asymmetric information between management and shareholders, it is likely that $\delta\neq\delta^*$. In fact, there may be times when management is not dressing up the project at all and shareholders attach δ to management's expectation in which case, doing so may be wealth reducing. For instance, if $E_m[\xi]+\delta^*=H$ and $\delta^*=0$ so that $E_m[\xi]=H$, and δ is large enough such that $E_m[\xi]-\delta<R$, then shareholder's desire to not undertake the project when undertaking the project is wealth maximizing. We also assume that:

$$\rho=\frac{E_m[\xi]}{E_m[\xi]+\delta^*}\in[0,1] \tag{1}$$

when $\delta^*=0$, then $\rho=1$ and management does not dress up the project when presenting it to shareholders. As δ^* increases, ρ decreases suggesting that the effect of the asymmetric information between management and shareholders is increasing.

We can interpret Eq. (1) as follows. The case of $\rho=1$ suggests that $E_m[\xi]\approx E_s[\xi]$. We assume that as management historically attempts to maximize shareholder wealth, shareholders will gain confidence in management's decisions and $\delta\to 0$. Therefore, there will be a high correlation between $E_m[\xi]$ and $E_s[\xi]$ for higher values of ρ. When δ^* is large, then shareholders will believe that management is dressing up the project and there will be a greater divergence between $E_m[\xi]$ and $E_s[\xi]$. We define the following probability.

$$\Pr(E_m[\xi]-R>\delta|E_m[\xi]+\delta^*=H)=q, \qquad \Pr(E_m[\xi]-R\le\delta|E_m[\xi]+\delta^*=H)=1-q.$$

That is, there exists some probability q, that shareholders will still wish to undertake the project even after compensating for potential asymmetric information about the project. Of course, this is conditional on the fact that $E_m[\xi]+\delta^*=H$ and management will present the project to shareholders. The probability q is the likelihood that shareholders will wish to undertake the project even after compensating for the possibility that management is dressing up the project. Likewise, the probability that shareholders will not wish to undertake the project is $1-q$.

There also exists a probability that shareholders will not wish to undertake the project when the project is actually profitable. Shareholders may overestimate the portion of management's expectation that is dressed up and attach a larger value δ when $\delta>\delta^*$. The probability is defined below.

$$\Pr(\delta>E_m[\xi]-R>\delta^*|E_m[\xi]+\delta^*=H)=\pi. \tag{2}$$

Shareholders will not wish to undertake profitable projects because they overestimate the amount of δ with a probability π. Again, this is conditional on $E_m[\xi]+\delta^*=H$ and management's willingness to present the project to shareholders. As mentioned earlier, this is the case when management flexibility is beneficial to the overall wealth of the firm. That is, if internal liquidity is available, then management will still be able to undertake the project even though shareholders will not wish to invest in the

[6] The analysis is unchanged if the project investment was some amount, say I, where $I\le R$.

project. In this case, FCF is advantageous to the wealth of the firm. The probability π is a subset of the probability $1-q$. That is, there exists a portion of the probability $1-q$, which is made up from shareholders wishing to reject profitable projects because they overestimate the value δ.

Management's actions: It is clear that when management is seeking to maximize shareholder's wealth, it will wish to invest in the new project when $E_m[\xi]=H$ (assuming $\delta^*=0$) and not when $E_m[\xi]=L$, if it has internal liquidity available, which will be the case if it chooses $D=0$.[7] Likewise, shareholders will wish to invest in the new project when $E_m[\xi]+\delta=H$ and not when $E_m[\xi]+\delta=L$. If the firm chooses $D=R$ at $t=0$, then it will need external financing at $t=1$ to invest in the project. If $E_m[\xi]+\delta=H$ then the investment will occur if

$$H-\tau>R \tag{3}$$

when Eq. (3) holds, it means the project is worth investing in when the payoff H less the transactions cost of raising external financing is greater than the cost of the investment. If the payoff is L, then management will not wish to invest in the new project, so that the investors' expectation of the payoff is a moot point. If $E_m[\xi]=H$ and $E_s[\xi]=L$, which is to say that $E_m[\xi]+\delta<L$, then management's ability to invest in the new project depends on whether the firm has internal liquidity available. If $D=R$ was chosen at $t=0$, management can invest in the new project only if investors are willing to provide external financing, and this happens only if $E_s[\xi]=H$. Thus, if $E_m[\xi]=H$ and $E_s[\xi]=L$ and external financing is required, management will be unable to invest in the new project. But if $D=0$ was chosen at $t=0$, we assume that there is a probability $\eta\in(0,1)$ that management will be able to invest in the new project even when $E_s[\xi]=L$. That is, if $E_s[\xi]=H$ and $E_s[\xi]=L$, management may be able to overcome investors' disagreement and invest in the new project if internal liquidity is available in the firm. We refer to η as the "flexibility parameter".

The idea behind this setup is that management calls the shots in running the firm, so if it has the internal liquidity available, it can invest in the project if it truly believes the project has a positive NPV or some other beneficial value. But this flexibility offered by internal liquidity is not unfettered. Depending on the intensiveness of corporate governance, shareholders may be able to pressure management into rejecting a project they think is a bad bet even if management believes the project is wealth maximizing or desire to undertake the project for self-interested reasons. The higher the value of η, the higher the probability that management will be able to overcome such objections by investing in a project it believes is wealth maximizing or beneficial in some other way when it has the internal liquidity to do so. Fig. 1 summarizes the sequence of events.

2.1. Discussion of the model

The model described thus far has two essential elements that are important for the analysis that follows. First, we allow management (insiders) and investors (outsiders) to have different assessments of the value of the firm's new project. This is based on the likelihood of shareholders having to compensate for the potential of management dressing up the project.

The second essential element is that we view a firm's dividend policy as influencing the flexibility management has in making investment decisions. By paying a dividend, management reduces the firm's internal liquidity, forcing (greater) reliance on external financing in the event that it wishes to invest in a new project. The crucial difference between external and internal financing that we exploit is that the former is simply unavailable if investors do not agree with management that the new project is a good bet, whereas the latter may be used to invest in a project even when investors disagree with management. Thus, an increase in dividend payments reduces management flexibility.

2.2. Interpretation of key parameters in the model

There are four key parameters in the model: the "decision parameter" π, the "asymmetric parameter" ρ, the "flexibility parameter" η, and the "management preference parameter" β, which we introduce in the analysis. We discuss each in turn below.

The parameter π, is the probability that shareholders overestimate the dressing up of the project by management reflected in management's expectation of the project's payout and desire to not undertake a profitable project. As π increases, management flexibility will become more important in the maximization of the firm's wealth.

We view ρ as the parameter that measures the level of asymmetric information in management's presentation of the expected payoff of the project to shareholders. If $\rho=1$, then there is no dressing up of the project by management. As ρ decreases, there is more asymmetric information in the presentation of the project by management to shareholders. As managers place a higher value on the private benefits of control, ρ will decrease, and the agency costs of FCF will increase.

The flexibility parameter η depends on management's track record in delivering performance and building shareholder value. Thus, the better the firm's performance, the greater will be the flexibility enjoyed by its management. That is, more powerful CEOs will enjoy higher values of η. We also expect η to be affected by the firm's ownership structure. Firms with more diffuse ownership structures are likely to have less shareholder intrusion into the management of the firm, and hence higher values of η for management.

[7] When $E_m[\xi]$=H, it means that management finds that the wealth maximizing portion of the expected payoff plus the personal benefits portion of the expected payoff is greater than R (the cost of the investment).

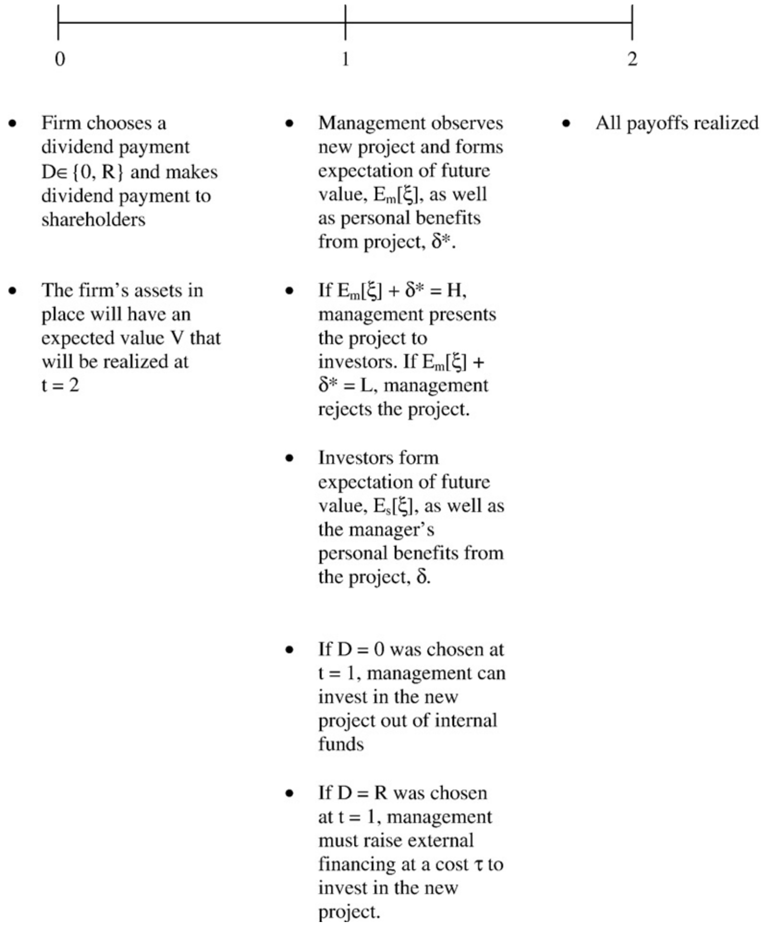

Fig. 1. Sequence of events.

Finally, the preference parameter β represents the weight management attaches to the initial stock price relative to the firm's terminal value. The more short-term the orientation of management, the higher will be β. For example, a CEO close to retirement is likely to have a higher β than one with a longer planning horizon.

3. Analysis

The analysis in this section is in two parts. First, we examine the firm's dividend decision at $t=0$ and derive our main result about when firms will pay dividends and when they will not. Second, we do comparative static analysis on the optimal dividend policy and extract testable predictions.[8]

3.1. The optimal dividend policy

To understand which firms will choose $D=R$ and which will choose $D=0$, we need to compare the values of management's objective function for $D=R$ and $D=0$. If management chooses $D=R$ at $t=0$, the value of management's objective function (after the dividend announcement but before the dividend is paid) is:

$$W(R) = R + q\rho[H-R] - q\rho\tau + \beta[R + q\rho(H-R) - q\rho\tau] + V(1+\beta). \tag{4}$$

Note first that if $q=0$, which is to say that if the dividend is paid and shareholders do not believe the project is worth undertaking, the firm is worth $R+V$, where R is the dividend to be paid and V is the value of the assets in place. In the management's objective function, this translates into $[R+V][1+\beta]$. If $q=1$, which is to say that shareholders believe the project is

[8] All proofs are located in the Appendix.

worth undertaking, the value of the firm becomes $(1+\beta)[(R+V+\rho[H-R]-\rho\tau]$ where $\rho\tau$ is the expected transaction cost of raising external financing for the project. Shareholders will value the firm similarly.

If management chooses $D=0$ at $t=0$, the value of management's objective function is:

$$W(0) = R + q\rho[H-R] + \pi\eta\rho[H-R] + \beta[R + q\rho[H-R] + \eta\rho(1-\pi)[L-R]] + V(1+\beta). \tag{5}$$

The main difference between Eqs. (4) and (5) is that now management will invest in the new project with probability η even when $E_m[\xi]=H$ and $E_s[\xi]=L$, which is partially reflected in the probability value of π. The project value in this case is assessed to be $H-R>0$ by management and $L-R<0$ by shareholders which can be a result of shareholders believing management is dressing up the project by the amount δ.

We will assume henceforth that:

$$\beta > \frac{H-R}{L-R}. \tag{6}$$

This assumption is necessary and sufficient to guarantee that at least some firms will pay dividends. The reason is simple. Suppose $\beta=0$, so management only cares about its own assessment of the initial shareholders' terminal wealth at $t=2$. In this case, it would never pay a dividend because paying a dividend entails two costs and no benefits: the loss of flexibility in that the new project must be passed up when $E_m[\xi]=H$ and $E_s[\xi]=L$, and the transaction cost τ associated with raising external financing in the state in which the new project is available and both management and shareholders want to invest. From the shareholders' standpoint, however, a dividend payment has a benefit precisely because it reduces management's flexibility. Reduced flexibility means management will not invest in the new project when $E_m[\xi]=H$ and $E_s[\xi]=L$. It is this benefit from the shareholders' perspective, reflected in the stock price at $t=0$, that creates a role for dividends. With $\beta>0$, management cares about the $t=0$ stock price, and hence is willing to pay a dividend in some circumstances if β is large enough. Comparing Eqs. (4) and (5) now leads to our first result.

Theorem 1. *There exists a critical value of the decision parameter, $\pi^* \in (0,1)$, such that the firm pays a dividend (chooses $D=R$) if $\pi \leq \pi^*$ and does not pay a dividend if $\pi > \pi^*$.*

The economic intuition is as follows. As we indicated earlier, if management cared only about the terminal value of the initial shareholders' wealth, it would never pay any dividends. What creates a preference for paying dividends is management's concern with the stock price at $t=0$. Now, when the likelihood of shareholders rejecting a profitable project because they believe management is overestimating the expectation of the project's payoff is low (that is, π is low), shareholders assess a high marginal cost of management flexibility associated with not paying a dividend. Consequently, the decline in the stock price at $t=0$ becomes larger as π becomes smaller, then the marginal cost associated with the negative stock price reaction to the increased flexibility associated with not paying a dividend exceeds the marginal benefit of increased flexibility to management. Hence, paying a dividend is more attractive to management when π is lower. For a sufficiently high π, the stock price-induced marginal cost of flexibility is sufficiently low compared to the sum of the marginal benefit of flexibility to management and the expected saving in transaction costs from not paying a dividend, so no dividend is paid.

Lemma 1. *The firm's stock price at $t=0$, P_0^s, is increasing in the decision parameter π when $D=0$.*

The intuition is simple, if FCF is beneficial to firm value, in terms of management flexibility, then when shareholders do not want to undertake a profitable project and the flexibility of not paying a dividend at $t=0$ allows management to still invest in the project, the investment will increase the stock price.

Theorem 2. *There exists a cutoff level of the stock price at $t=0$, $\overline{P_0^s}$, such that the firm will be observed to pay a dividend if $P_0^s < \overline{P_0^s}$ and not pay a dividend if $P_0^s \geq \overline{P_0^s}$. Moreover, the marginal value assigned by investors at $t=0$ to a dividend payment is higher when the stock price at $t=0$ is lower.*

The intuition is based on Theorem 1 and Lemma 1. Theorem 1 tells us that there is a cutoff value π^* of the decision parameter π, such that a dividend is paid only if $\pi<\pi^*$. Lemma 1 says that the stock price at $t=0$ is increasing in π. It follows that dividends will only be paid when the stock price is sufficiently low.

The second part of the theorem is also intuitive. As the stock price at $t=0$ declines with π, the marginal cost of flexibility as assessed by investors increases. Thus, a dividend payment is more highly valued at lower stock prices.

This theorem has two empirical predictions that we later take to the data. One is that there will be an inverse relationship between stock prices and dividends. The other is that dividends will be more highly valued when prices are lower.

Corollary 1. *The probability (assessed at $t=0$) that the firm will invest in the new project is lower when $D=R$ is chosen than when $D=0$ is chosen. Thus, the probability of investing in the new project is increasing in the firm's stock price.*

The reason why the probability of the new project being undertaken is higher when $D=0$ is that not paying a dividend leaves management with greater flexibility. The fact that this greater flexibility results in a higher probability of investing in the new project follows from our earlier discussion. From Theorem 2 we know that dividend payments are declining in firms' stock price levels. It follows then that the probability of investing in the new project is increasing in the firm's stock price.

3.2. Comparative statics

In this subsection, we analyze the comparative statics related to the optimal dividend policy.

Theorem 3. *The critical value, π^*, of the decision parameter, such that a firm with $\pi<\pi^*$ pays a dividend $D=R$ and a firm with $\pi\geq\pi^*$ does not pay a dividend, decreases as η increases, increases as β increases, and decreases as τ decreases. It is independent of the probability q (the probability that shareholders will wish to undertake the project given that management wishes to undertake the project).*

This theorem is intuitive. As π^* increases, the likelihood that $\pi^*\leq\pi$ decreases and the firm decides to not pay a dividend which ultimately decreases the level of management flexibility. As β increases, so does the weight management puts on the stock price at $t=0$ relative to its own assessment of the expected value of terminal wealth ($t=2$) of initial shareholders. Management thus attaches more weight in its decision making to the adverse impact of not paying a dividend on the firm's stock price at $t=0$. As π^* increases, the likelihood that $\pi^*\leq\pi$ decreases and when $\pi^*>\pi$, it is more profitable to issue the dividend at $t=0$.

An increase in the transaction cost τ of raising external financing makes it more costly to pay a dividend, thereby reducing π^*. Finally, while it may seem surprising at first blush why q, the probability that shareholders will desire to undertake the project given that management wishes to undertake the project, does not affect the firm's dividend policy, the intuition is as follows. As the probability of shareholders wishing to undertake the project increases, there will be no effect on whether they will reject a profitable project.

It might appear that if management cared solely about the stock price at $t=0$, it would always (regardless of the decision parameter π) pay a dividend. The following results show that this is not true. That is, despite shareholders' aversion to giving management flexibility and being overruled, shareholders may still want the firm to not pay dividends in some circumstances.

Theorem 4. *There exists a cutoff value, π^o, of the decision parameter such that the stock price at $t=0$ is maximized by paying the dividend if $\pi<\pi^o$ and by not paying a dividend if $\pi^o\leq\pi$. Moreover, $\pi^o>\pi^*$, where π^* is the corresponding cutoff value of π when management determines whether to pay a dividend.*

The reason why even the initial shareholders may prefer that the firm not pay a dividend is that the shareholders face a tradeoff between the cost of giving the management flexibility by not demanding a dividend and the expected transaction cost that would be incurred in raising external financing if the firm did pay a dividend. When the decision parameter π is sufficiently high, the shareholders assess a relatively low cost of conceding flexibility to management and a relatively high-expected transaction cost of raising external financing.[9] Thus, the shareholders find it optimal not to receive a dividend payment.

It is also intuitive that the optimal decision-parameter cutoff from the shareholders' standpoint, π^o, exceeds π^*, the cutoff that is optimal for management. Shareholders attach only a cost of management flexibility, whereas management assesses both a cost – via the impact of flexibility on the initial stock price – and a benefit to flexibility. Thus, management pays dividends under fewer circumstances than shareholders would like.

4. Empirical predictions

In this section we summarize the empirical predictions that emerge from our analysis.

Testable prediction 1: Dividend payments will be negatively correlated with stock price levels, i.e., more dividends are paid when stock prices are lower.

This prediction is based on Theorem 2. It is reminiscent of the Baker and Wurgler (2002) finding that firms' capital structure decision appears to be driven by their stock price levels. Our analysis predicts that this is true for the dividend decision as well. This prediction also distinguishes our flexibility hypothesis from the FCF hypothesis and the signaling hypothesis. The signaling hypothesis has no prediction about the correlation between stock prices and dividend payments.[10] While the FCF hypothesis does not directly speak to any relationship between dividends and stock prices, it indirectly suggests that stock prices should be positively correlated with dividend payments. When firms have higher earnings, their stock prices tend to be higher, and there is also more FCF to dissipate. To cope with this FCF problem, firms should pay higher dividends. However, our analysis shows that FCF can be advantageous to the wealth of the firm and therefore, when stock prices are higher and FCF exists, some firms will choose not to issue a dividend in order to allow for more flexibility in their investment decisions.

Testable prediction 2: Dividends will be more highly valued by investors when stock prices are low than when they are high.

This prediction also comes from Theorem 2. It indicates that investors will value dividends more highly when prices are low

[9] Note that this expected transaction cost is $\rho\tau$ which is increasing in π.

[10] Signaling models predict a positive announcement effect accompanying a dividend increase, but do not make any predictions about the dependence of dividends on the level of stock prices.

than when prices are high. This prediction is consistent with the findings of Fuller and Goldstein (2006) who find that dividend-paying firms outperform non-dividend-paying firms in bear markets (when prices are low) after controlling for various risk factors.

Testable prediction 3: In the cross-section of firms, a firm's idiosyncratic risk is inversely related to its dividend payout.

This prediction follows from Corollary 1. That corollary asserts that the probability of investing in the new project declines as the firm's dividend payment increases. If we assume that investment in the project at $t=1$ increases the firm's idiosyncratic risk, then as a firm's dividend payment increases, the firm's idiosyncratic risk decreases.

Testable prediction 4: There will be a positive correlation between the level of the firm's stock price and its idiosyncratic risk.

This prediction also follows from Corollary 1. A higher stock price leads to a lower dividend, which then leads to a higher probability of investing in the project, which elevates the firm's idiosyncratic risk, assuming that investing in the project increases idiosyncratic risk.

An additional testable prediction: Firms with lower debt–equity ratios pay lower dividends. That is, there is a positive cross-sectional relationship between dividends and debt–equity ratios.

The additional prediction is not a direct result of the analysis. We recognize that our model assumes that the firm is all equity financed and therefore, debt–equity ratios may be irrelevant. However, it is likely in the real world that firms carry some level of debt and therefore, we are interested in the relationship between the debt–equity ratio and dividend payments. The prediction is generated by joining together Theorem 2, which states that higher stock prices lead to lower dividends, and the empirical findings of numerous papers [e.g. Baker and Wurgler (2002)] that higher stock prices lead firms to issue equity and causes their debt–equity ratios to decline.[11] Further, Jensen (1986) argues that dividends and debt are substitutes and both reduce the agency costs of FCF. Our model shows that FCF can be advantageous to firm wealth in the form of management flexibility. Additionally, DeAngelo and DeAngelo (2006) show that capital structure decisions are made based on the preservation of financial flexibility. Therefore, a prediction of direct correlation between debt and dividends suggests that firms that carry low debt will also pay fewer dividends because the firm values flexibility. In other words, our analysis predicts that there is a brighter side to FCF. Using the debt–equity ratio as a robustness test will help confirm whether some firms view FCF as beneficial as well as add to the flexibility theory of DeAngelo and DeAngelo.

An additional testable prediction: Firms that pay lower dividends will maintain higher levels of liquidity (cash and marketable securities). However, higher levels of liquidity will not be at the expense of operating efficiency.

This prediction arises from the fact that a firm that chooses not to pay a dividend in our analysis retains the cash to maintain the flexibility to make a future investment. If some shareholders' value management flexibility, then they will assume that the cash will not be dissipated in wasteful spending or stolen by managers. This prediction sharply delineates our analysis from the agency-motivated explanation that a dividend payment is primarily a mechanism to minimize spending inefficiency [Jensen (1986)] or managerial expropriation [e.g. La Porta et al. (2000)]. Thus, in addition to examining the relationship between dividends and liquidity, we could look at the linkage between operating efficiencies and dividend payouts of firms in order to run an empirical horse race between flexibility and FCF as determinants of corporate dividends. The FCF prediction is that firms that pay fewer dividends would have lower operating efficiency since the excess cash kept in the firm would be wasted. Flexibility predicts no relation between dividends and the firm's operating efficiency.

The model does predict other relations that have been empirically found consistent with our theory. First, our model suggests that the greater the concern of management with the current stock price (as opposed to the future value of the firm), the higher the dividend. From Theorem 3, which tells us that π^*, the cutoff decision parameter is increasing in β, the weight management attaches to the current stock price in its preference function. One potential test would be to examine if the stock-option component of managerial pay (tied specifically to the future value of the firm) is inversely related to the firm's dividend payments, since an increase in the stock-option component would imply a lower β. Bhattacharya et al. (2006) find that the stock-option component of managerial compensation is significantly and negatively related to the dividends paid by the firm.

Second, our model predicts that the more diffuse the firm's ownership structure, the higher is its dividend payout. Again, from Theorem 3, if π^* increases, then the likelihood of $\pi>\pi^*$ decreases suggesting the firm will be more likely to pay a dividend and decrease the level of flexibility (or the flexibility parameter η, will decrease). We interpret η as a parameter that takes higher values as ownership becomes more diffuse, since shareholders with smaller ownership stakes have weaker incentives to produce information about the firm and intervene in management decisions. If greater institutional holdings indicate a less diffuse ownership, then firms with greater institutional holdings should have lower dividend payouts. It can be argued that a less diffuse ownership is less likely to overestimate the amount of management's expectation that is “dressed up”, thus decreasing the value of π which will increases the likelihood of management paying a dividend thus, decreasing flexibility. Grinstein and Michaely (2005) find that institutional holdings are greater for low-dividend yielding stocks than for high-dividend yielding stocks.[12]

5. Data, tests, and results

In this section, we test predictions 1 through 4 and the two additional predictions outlined in the previous section. We gather dividend-paying and non-dividend-paying firms from 1980 through 2000. For a firm to be included in the sample, the following criteria must be satisfied:

i) The firm is listed on the Compustat database.

[11] This has been theoretically predicted by Zwiebel (1996).

[12] They also find that institutional holdings are greater for dividend-paying firms than for non-dividend-paying firms.

Table 1
Sample statistics

Variable	Mean	Standard deviation	Minimum	Maximum
D/E	1.8358	85.6611	0.00002	9284.62
Idiosyncratic risk	0.1001	0.8001	0.0021	1.3746
Cash	0.1201	0.1720	0.0000	1.0000
Market capitalization (in $000)	976,752.56	4,596,975.13	3.7187	256,593,797
R&D	0.0730	0.3116	0	14.5968
Dividend	0.6306	1.0902	0	45.0000
Dividend yield	0.0276	0.1082	0	8.0000
Dividend/net income	0.0016	0.0053	0	0.1371
Dividend/financial slack	0.2876	1.2540	0	67.905

Sample statistics for 2,407 dividend-paying and non-dividend paying firms listed on Compustat between 1980 and 2000.

ii) The firm is listed on the daily and monthly Center for Research in Security Prices (CRSP).
iii) The non-utility and financial firms had to have an Altman's *Z* score of 2.68 or greater.

The first and second restrictions allow us to collect the accounting and return data necessary to test our predictions. The third restriction controls for high-credit-risk firms that are highly likely to become insolvent in the near future. Altman's *Z* score suggests that firms with *Z* scores less 2.68 have a high likelihood of going bankrupt. The *Z* score is computed as follows:

$$Z = 0.012X_1 + 0.014X_2 + 0.033X_3 + 0.006X_4 + 0.999X_5 \tag{7}$$

where X_1 is working capital (Compustat item #4 minus Compustat item #5) divided by total assets (Compustat item #6) (in percentage), X_2 is retained earnings (Compustat item #36) divided by total assets (in percentage), X_3 is earnings before interest and taxes (Compustat item #13 minus Compustat item #14) divided by total assets (in percentage), X_4 is market value of equity (Compustat item #24 times Compustat item #25) divided by book value of total debt (Compustat item #9 plus Compustat item #34) (in percentage), and X_5 is sales (Compustat item #12) divided by total assets (actual number). Table 1 presents the sample statistics for the 2407 firms in our sample.

We begin by examining Prediction 1: when prices are high, dividend yields and dividend payments are low. We define high-price periods as those during which the Standard and Poor's 500 index (SP500) had a positive yearly return, and low-price periods as those during which the SP500 had a negative or zero return for the year.[13] We also distinguish within the high-price and low-price periods when the stocks in our sample are higher priced and lower priced. Firms are classified as low-priced firms if their price is lower than the median firm price of all firms that year and high-priced firms if their price is greater than the median firm price of all firms that year. Next we calculate the firm's dividend yield as the yearly dividend (Compustat item #26) divided by the year-end price (Compustat item #24). We also examine the firms' yearly raw dividend payments, as well as the yearly dividend payment divided by the firm's financial slack. We measure financial slack as the firm's cash plus liquid securities. We also include the yearly dividend payment divided by the net income for those firms with non-negative net income. For the remainder of the paper, we will refer to the four dividend measures as dividend payouts. Table 2 Panel A indicates that the dividend payouts are all significantly higher during low-price periods than during high-price periods. During low-price periods, all low-priced firms have significantly higher dividend payouts than high-priced firms (see Panel B). However, during high-price periods, the results are not consistent across all dividend payouts. Panel C reports that just the dividend yield and the dividend payment divided by the financial slack are significantly higher for low-priced firms than for high-priced firms. The results of Table 2 are consistent with our theoretical predictions and indirectly suggest that dividend policies are set with financial flexibility in mind.

Next we turn to Prediction 2: investors value dividends more when prices are low than when prices are high. We compare the returns of dividend-paying stocks to non-dividend paying stocks for low-price periods, and repeat this comparison for high-price periods. We define a firm as dividend paying if it paid a dividend in that year while a firm that did not pay a dividend is defined as non-dividend paying for that year. Thus, firms can change classification from year to year. In testing Prediction 1, we are constrained to use yearly definitions of low-price and high-price markets since the dividend payouts were defined as yearly payouts. However, since testing Prediction 2 does not directly involve dividend payouts (used only to classify dividend-paying and non-dividend paying firms) but examines firm returns, we can classify low-price and high-price markets based on monthly SP500 returns. A high-price market is defined as a month during which the monthly return on the SP500 was positive, while a low-price market is one where the SP500 posted a negative or zero monthly return. To control for risk we classify each firm into beta deciles where beta was measured using the firm's daily returns for the prior year. Finally, we compare the monthly return for dividend-paying stocks versus non-dividend-paying stocks for each decile for low-price and high-price markets. As Table 3 Panel A indicates returns are significantly higher for dividend-paying firms than for non-dividend paying firms in low-price markets for all beta deciles. However, non-dividend paying firms significantly outperform dividend-paying firms for high-price markets across all beta deciles.

[13] As a robustness check, we also classified high price periods as bull markets and low price periods as bear markets. To define a bull market, we obtain bull and bear market definitions from Ned Davis Research. Ned Davis Research defines a bull market as an increase of the Dow Jones Industrial Average (DJIA) of at least 30% over 50 calendar days or a 13% increase over 155 calendar days and a bear market as a decrease of the DJIA of at least 30% over 50 calendar days or a 13% decrease over 145 calendar days. Ned Davis Research classifies each month as a bull or bear market. However, since our data are yearly, we define a bull (bear) market year as a year in which the majority (more than six) of the monthly observations were classified as bull (bear) markets. We also required that nine or more months be classified as bull (bear) markets for the year to be a bull (bear) year. This allowed some months to be fall as neither bull nor bear and these were removed from the analysis for this test. Results were qualitatively similar and are available upon request.

Table 2
Average dividend payouts partitioned by market conditions

	Dividend yield	Raw dividend	Dividend/net income	Dividend/financial slack
Panel A: Market prices				
Low-price period	0.0335	0.6895	0.0661	0.3281
High-price period	0.0268	0.6195	0.0370	0.2218
Difference	0.0067**,w,k	0.0700**,w,k	0.0291**,w,k	0.1063**,w,k
Panel B: Market low-price period				
Low-priced firms	0.0449	0.6971	0.1459	0.5743
High-priced firms	0.0260	0.6721	0.0504	0.2512
Difference	0.0189**,w,k	0.0250**,w,k	0.0955**,w,k	0.3231**,w,k
Panel C: Market high-price period				
Low-priced firms	0.0285	0.5846	0.0584	0.3216
High-priced firms	0.0261	0.6298	0.0591	0.1457
Difference	0.0024**,w,k	−0.0452**,w,k	−0.0007*	0.1759**,w,k

Dividend payouts for 2,407 dividend-paying and non-dividend-paying firms between 1980 and 2000. Dividend payouts are measured as the firm's dividend yield, the firms' yearly raw dividend payments, the firm's dividend standardized by net income, as well as the dividend payment divided by the firm's financial slack. Panel A indicates for all firms during high-price and low-price periods. High-price periods are defined as those during which the SP500 index had a positive yearly return, and low-price periods as those during which the SP500 index had a negative or zero return for the year. Panels B and C report the dividend payouts partitioned by high- and low-price periods as well as if the firm was high or low price during the year. Firms are divided as low-priced firms if their price is lower than the median firm price of all firms that year and high-priced firms if their price is greater than the median firm price of all firms that year.
[w]Indicates the Wilcoxon sign-rank test is significant at the 1% level.
[k]Indicates the Kruskal–Wallis test is significant at the 1% level.
* Indicates *t*-test is significant at the 5% level.
** Indicates *t*-test is significant at the 1% level.

We also examine the abnormal return for each firm f using the Capital Asset Pricing Model to determine expected returns. That is, we estimate

$$\text{Abnormal Return}_f = \text{Actual Return}_f - \left(r_F - \beta_f(r_M - r_F)\right) \tag{8}$$

where Actual Return_f is the return for firm f for that month, r_F is the three-month Treasury bill for that month, r_M is the return on the CRSP equally-weighted portfolio, and β_f is the beta for stock f. We then compare the abnormal returns for dividend-paying stocks versus non-dividend paying stocks in low-price and high-price markets. Again, the results in Table 3 Panel B show that, compared to non-dividend-paying stocks, dividend-paying stocks exhibit higher abnormal returns during low-price markets, and lower abnormal returns during high-price markets.

Another way to test Prediction 2 is to examine dividend changes. We would expect that in low-price markets dividend increases should have higher price reactions than in high-price markets and dividend decreases would have lower (less negative) price reactions in low-price markets than high-price markets. We examine changes (both increases and decreases) in quarterly dividends for 3,496 firms gathered from CRSP from 1980 to 2000. The only restrictions we place on the sample it that there must be five days of returns surrounding the announcement listed on CRSP, the dividend is paid on ordinary common shares of U.S.-incorporated companies, the stock price is greater than $2 per share, and the change cannot be a dividend initiation or omission. Our sample included 11,805 dividend increases and 8,760 dividend decreases. Two-thirds of our decreases occurred from 1990 to 2000 while increases were evenly spread between the 1980s and 1990s. We follow Brown and Warner's (1985) standard event study methodology to calculate CARs for the five-day period (−2, 2) around the announcement date supplied by CRSP. We estimate the abnormal returns using a modified market model:

$$AR_i = r_i - r_{\mathrm{M}} \tag{9}$$

where r_i is the return on firm i and r_{M} is the equally-weighted market index return. We do not estimate market parameters based on a time period before each change since some firms have frequent dividend changes and thus, there is a high probability that previous changes would be included in the estimation period thus making beta estimations less meaningful. Additionally, it has been shown that for short-window event studies weighting the market return by the firm's beta does not significantly improve estimation.[14]

As shown in Table 4, price reactions to dividend increases are less in high-price markets than in low-price markets but dividend decreases have less negative returns if announced during low-price markets than high price markets. Further, dividend decreases announced during low-price markets have an insignificant impact on the firm's stock price. This is probably due to the fact that cutting a dividend when the market is doing well is a clearer signal that the firm is having problems. However, if a firm cuts a dividend when the entire market is doing poor, there may be less information in the dividend cut or the market views may view the cut as an appropriate step by management to undertake given current economic conditions.[15]

[14] See Brown and Warner (1980) for comparison of the market model with the market-and-risk-adjusted model.
[15] As a robustness check, we divided the sample into the 1980s and the 1990s. We find that the same pattern holds across both decades; firms that increase (decrease) dividends in high-price markets have higher (lower) abnormal returns than firms that increase (decrease) dividends in low-price markets. Similar to Amihud and Li (2006) the abnormal returns are lower in the 1990s than 1980s.

Table 3
Average returns and abnormal returns for dividend and non-dividend-paying stocks partitioned by risk and low-price and high-price markets

Panel A: By beta decile

Beta decile	Non-dividend paying	Dividend paying	Difference
Low-price markets			
High	−5.21%	−4.02%	−1.19%**,w,k
2	−2.90%	−2.70%	−0.20%**,w,k
3	−3.33%	−2.30%	−1.03%**,w,k
4	−2.61%	−2.14%	−0.47%**,w,k
5	−1.71%	−1.70%	−0.01%w,k
6	−1.72%	−1.32%	−0.40%**,w,k
7	−1.65%	−0.69%	−0.96%**,w,k
8	−2.34%	−0.23%	−2.11%**,w,k
9	−1.21%	0.38%	−1.59%**,w,k
Low	−1.72%	0.33%	−2.05%**,w,k
High-price markets			
High	6.21%	5.57%	0.64%w,k
2	4.94%	4.84%	0.10%w,k
3	4.69%	3.93%	0.76%*,w,k
4	4.81%	3.64%	1.17%**,w,k
5	4.04%	3.12%	0.92%**,w,k
6	3.91%	2.88%	1.03%**,w,k
7	3.90%	2.52%	1.38%**,w,k
8	3.87%	2.58%	1.29%**,w,k
9	2.71%	2.43%	0.29%w,k
Low	3.51%	2.56%	1.25%**,w,k

Panel B: Abnormal returns

	Non-dividend paying	Dividend paying	Difference
Low-price markets			
Return	−0.79%	0.29%	−1.08%**,w,k
High-price markets			
Return	1.99%	0.95%	1.04%**,w,k

Panel A reports the average monthly return to 2,407 dividend- and non-dividend-paying stocks in high-price and low-price markets from 1980 to 2000. High-price markets are when the SP500 index monthly return was greater than zero and low-price markets are when the SP500 index monthly return was zero or less. Panel A reports the average monthly returns once firms have been classified by their CRSP beta deciles for low-price and high-price markets. Panel B reports the average monthly abnormal return to dividend- and non-dividend-paying stocks in low-price and high-price markets from 1980 to 2000.
[w]Indicates the Wilcoxon sign-rank test is significant at the 1% level.
[k]Indicates the Kruskal–Wallis test is significant at the 1% level.
* Indicates t-test is significant at the 5% level.
** Indicates t-test is significant at the 1% level.

We recognize that the negative correlation between stock prices and dividends has alternative explanations. Firms may change their dividend policies in order to signal future growth opportunities when market prices decrease. The results of our first prediction suggest that either flexibility is valued more when stock prices are high or companies change dividend policies based on price levels. As Denis and Osobov (in press) find, large profitable firms pay the most dividends suggesting that signaling theories do not fully explain dividends.

Next we examine Prediction 3 that firms that pay less in dividends exhibit lower idiosyncratic risk. Using the market model, we construct a measure of idiosyncratic risk as follows.[16] For each stock, we regress the past year's daily excess returns on the market excess return:

$$r_{ft} - r_F = \alpha + \beta_f (r_{Mt} - r_F) + \varepsilon_{ft} \tag{10}$$

where r_{ft} is the daily return t for firm f, r_F is the three-month Treasury bill for that month, r_{Mt} is the daily return on the CRSP equally-weighted portfolio, and β_f is the beta for stock f. The cross-sectional average of the residuals squared is used to construct the measure of average idiosyncratic risk. We define Risk as the measure of idiosyncratic risk computed as:

$$\text{Risk} = \frac{1}{N} \sum_{i=1}^{N_t} \left(\varepsilon_{ft}\right)^2. \tag{11}$$

We quartile our data based on the idiosyncratic risk estimated for each year. That is, for each year we classify each firm into one of four quartiles based on cutoffs for that year. Firms can and do change quartiles over time. Then, we compare the dividend

[16] Goyal and Santa-Clara (2003) find that the idiosyncratic component represents 85% of the total average stock variance according to the market model, and 80% according to the Fama-French three-factor model.

Table 4
Cumulative abnormal returns for dividend changes partitioned low-price and high-price markets

Panel A

	Dividend increase	Dividend decrease	Difference
	1.207%**	−0.181%**	1.388%**,w,k

Panel B

	High-Price Market	Low-Price Market	Difference
Dividend increase	1.124%**	1.357%**	−0.233%*,w,k
Dividend decrease	−0.280%**	−0.002	−0.282%**,w,k

Cumulative abnormal returns (CAR) are calculated for the five days (−2, 2) around the announcement (day 0) of a dividend change. Abnormal returns are estimated using a modified market model

$$AR_i = r_i - r_M$$

where r_i is the return on firm i and r_M is the equally-weighted market index return. The usual estimation period is eliminated due to the high probability of previous dividend changes for firms during the estimation period. Panel A reports the CARs for 20,565 dividend changes (11,805 increases and 8,760 decreases) announced from 1980 to 2000 for 3,496 firms. Panel B reports the CAR for dividend increases and decreases in high-price and low-price markets from 1980 to 2000. High-price markets are when the SP500 index monthly return was greater than zero and low-price markets are when the SP500 index monthly return was zero or less.
[w]Indicates the Wilcoxon sign-rank test is significant at the 1% level.
[k]Indicates the Kruskal–Wallis test is significant at the 1% level.
* Indicates *t*-test is significant at the 5% level.
** Indicates *t*-test is significant at the 1% level.

Table 5
Relation between idiosyncratic risk and dividend payouts

Panel A

	Dividend yield	Raw dividend	Dividend/net income	Dividend/financial slack
Low risk	0.0502	1.3016	0.1028	0.8328
2	0.0209	0.4327	0.0560	0.1595
3	0.0079	0.0978	0.0330	0.0852
High risk	0.0050	0.0272	0.0262	0.0306

Panel B

	Low risk	2	3	High risk
Differences in dividend yield				
Low risk	–	0.0293**,w,k	0.0423**,w,k	0.0452**,w,k
2		–	0.013**,w,k	0.0159**,w,k
3			–	0.0029
High risk				–
Differences in raw dividends				
Low risk	–	0.8689**,w,k	1.2038**,w,k	1.2744**,w,k
2		–	0.3349**,w,k	0.4055**,w,k
3			–	0.0706**,w,k
High risk				–
Differences in dividend/net income				
Low risk	–	0.0468**,w,k	0.0698**,w,k	0.0766**,w,k
2		–	0.023**,w,k	0.0298*,w,k
3			–	0.0068
High risk				–
Differences in dividends/financial slack				
Low risk	–	0.6733**,w,k	0.7476**,w,k	0.8022**,w,k
2		–	0.0743**,w,k	0.1289**,w,k
3			–	0.0546
High risk				–

Panel A reports the average dividend payouts quartiled by the firm's idiosyncratic risk for 2,407 dividend-paying and non-dividend-paying firms from 1980 to 2000. Dividend payouts are measured as the firm's dividend yield, the firms' yearly raw dividend payments, the firm's dividend standardized by net income, as well as the dividend payment divided by the firm's financial slack. Panel B reports the *t*-tests for differences in means reported in Panel A. The column mean is subtracted from the row mean to calculate the difference reported. For example, for the dividend yield, the quartile-2 mean, 0.0209, is subtracted from the Low risk quartile mean, 0.0502, for a difference of 0.0293.
[w]Indicates the Wilcoxon sign-rank test is significant at the 1% level.
[k]Indicates the Kruskal–Wallis test is significant at the 1% level.
* Indicates *t*-test is significant at the 5% level.
** Indicates *t*-test is significant at the 1% level.

Table 6
Relation between debt–equity ratios and dividend payouts

Panel A

	Dividend yield	Raw dividend	Dividend/net income	Dividend/financial slack
Low *D*/*E*	0.0043	0.1105	0.0019	0.0089
2	0.0111	0.1978	0.0329	0.1211
3	0.0779	0.7980	0.0779	0.4293
High *D*/*E*	0.1149	0.7641	0.1149	0.5644

Panel B

	Low D/E	2	3	High D/E
Differences in dividend yield				
Low *D*/*E*	–	−0.0068 **,w,k	−0.0736 **,w,k	−0.1106 **,w,k
2		–	−0.0668 **,w,k	−0.1038 **,w,k
3			–	−0.0370 *,w,k
High *D*/*E*				–
Differences in raw dividends				
Low *D*/*E*	–	−0.0873 **,w,k	−0.6875 **,w,k	−0.6536 **,w,k
2		–	−0.6002 **,w,k	−0.5663 **,w,k
3			–	0.0339
High *D*/*E*				–
Differences in dividend/net income				
Low *D*/*E*	–	−0.0310 **,w,k	−0.0760 **,w,k	−0.1130 **,w,k
2		–	−0.0450 **,w,k	−0.0820 **,w,k
3			–	−0.0370 **,w,k
High *D*/*E*				–
Differences in dividends/financial slack				
Low *D*/*E*	–	−0.1122 *,w,k	−0.4204 **,w,k	−0.5555 **,w,k
2		–	−0.3082 **,w,k	−0.4433 **,w,k
3			–	−0.1351
High *D*/*E*				–

Panel A reports the average dividend payouts quartiled by the firm's debt-to-equity ratio for 2,407 dividend-paying and non-dividend-paying firms from 1980 to 2000. Dividend payouts are measured as the firm's dividend yield, the firms' yearly raw dividend payments, the firm's dividend standardized by net income, as well as the dividend payment divided by the firm's financial slack. Panel B reports the *t*-tests for differences in means reported in Panel A. The column mean is subtracted from the row mean to calculate the difference reported. For example, for the dividend yield, the quartile-2 mean, 0.0111, is subtracted from the Low *D*/*E* quartile mean, 0.0043, for a difference of −0.0068.

[w]Indicates the Wilcoxon sign-rank test is significant at the 1% level.

[k]Indicates the Kruskal–Wallis test is significant at the 1% level.

* Indicates *t*-test is significant at the 5% level.

** Indicates *t*-test is significant at the 1% level.

payouts for the four quartiles. We would expect that firms with the lowest idiosyncratic risk would have the largest dividend payouts. Table 5 shows that indeed there is an inverse, monotonic relation between dividend payouts and idiosyncratic risk. Further, dividend payouts are significantly different across the quartiles.

Prediction 4 says that a positive correlation exists between the level of a firm's stock price and its idiosyncratic risk. According to our model, firms with price levels greater than the cutoff price will not pay dividends but will take projects that increase idiosyncratic risk. Thus, to test this prediction we must condition on stock prices. We partitioned our sample into higher-price firms, those with prices greater than the yearly median price, and lower-price firms, those with prices less than the yearly median price, and determine the correlation between risk and price. For higher-price firms, the correlation coefficient between stock price and idiosyncratic risk is 0.197, which is significant at the 1% level. For lower-price firms, the correlation coefficient is −0.328, which is also significant at the 1% level.

We recognize that predictions 3 and 4 have multiple interpretations. According to signaling theories, dividends are paid to signal future earnings that may be obtained by investing in projects that increase a firm's idiosyncratic risk. Therefore, signaling theory suggests that the correlation between dividend payments and idiosyncratic risk is positively related, which is counter to the predictions of our model. However, FCF theory indirectly predicts the negative correlation between dividend payments and unsystematic risk. Shareholders may demand dividends in order to decrease the likelihood that firm flexibility allows management to invest in pet project that may ultimately increase idiosyncratic risk.

Our theory suggests that the brighter side of FCF is that when shareholders overestimate the asymmetric information in the presentation of investment projects by management, profitable investment projects may not be undertaken. Again, our model assumes that management is presenting projects to shareholders in full information, in which case the negative correlation between dividends and idiosyncratic risk is consistent with the flexibility of dividend policy.

Table 7
Relation between liquidity (cash) and dividend payouts

Panel A

	Dividend yield	Raw dividend	Dividend/net income	Dividend/financial slack
Low cash	0.0394	0.9884	0.0822	1.0053
2	0.0264	0.5417	0.0746	0.1184
3	0.0118	0.2415	0.0618	0.0164
High cash	0.0065	0.0964	0.0199	0.0042

Panel B

	Low cash	2	3	High cash
Differences in dividend yield				
Low cash	–	0.0130^{**,w,k}	0.0276^{**,w,k}	0.0329^{**,w,k}
2		–	0.0146^{**,w,k}	0.0199^{**,w,k}
3			–	0.0053^{**,w,k}
High cash				–
Differences in raw dividends				
Low cash	–	0.4467^{**,w,k}	0.7469^{**,w,k}	0.8920^{**,w,k}
2		–	0.3002^{**,w,k}	0.4453^{**,w,k}
3			–	0.1451^{**,w,k}
High cash				–
Differences in dividend/net income				
Low cash	–	0.0076	0.0204	0.0623^{**,w,k}
2		–	0.0128	0.0547^{**,w,k}
3			–	0.0419^{**,w,k}
High cash				–
Differences in dividends/financial slack				
Low cash	–	0.8869^{**,w,k}	0.9889^{**,w,k}	1.0011^{**,w,k}
2		–	0.1020^{*,w,k}	0.1142^{*,w,k}
3			–	0.0122^{**,w,k}
High cash				–

Panel A reports the average dividend payouts quartiled by the firm's idiosyncratic risk for 2,407 dividend-paying and non-dividend-paying firms from 1980 to 2000. Dividend payouts are measured as the firm's dividend yield, the firms' yearly raw dividend payments, the firm's dividend standardized by net income, as well as the dividend payment divided by the firm's financial slack. Panel B reports the *t*-tests for differences in means reported in Panel A. The column mean is subtracted from the row mean to calculate the difference reported. For example, for the dividend yield, the quartile-2 mean, 0.0264, is subtracted from the Low cash quartile mean, 0.0394, for a difference of 0.0130.
[w] Indicates the Wilcoxon sign-rank test is significant at the 1% level.
[k] Indicates the Kruskal–Wallis test is significant at the 1% level.
* Indicates *t*-test is significant at the 5% level.
** Indicates *t*-test is significant at the 1% level.

We also test two additional predictions that are indirectly a result of our analysis. The first prediction states that debt–equity ratios and dividends are positively related in the cross-section. We calculate the debt–equity ratio as the total debt for a firm divided by the market value of the firm's equity. Again we divide the sample into quartiles based on the firm's debt–equity ratio each year and compare the dividend payouts across the quartiles. Table 6 shows that indeed there is a positive and monotonic relation between dividend payouts and debt–equity ratios. Further, these values of dividend payouts are significantly different across the quartiles.[17]

The second indirect prediction says first that firms with more liquidity will have lower dividend payments. We calculate the liquidity of the firm as the cash and short-term investments (Compustat item #1) standardized by the firm's total assets each year. We quartile the sample based on the firm' liquidity for each year and compare the dividend payouts across the quartiles. Table 7 reports an inverse and monotonic relation between dividend payouts and liquidity holdings of the firm. Further, these values of dividend payouts are significantly different across the quartiles. This is consistent the DeAngelo et al. (2006) that firms with more cash are less likely to pay dividends.

While our results are supportive of the flexibility theory of dividends, we must be careful in interpreting these univariate results. Since our data extend from 1980 to 2000, we need to control for any time trend in the data. Also, there may be interaction between liquidity, D/E, idiosyncratic risk, firm size, operating performance and growth opportunities, which suggests the need for a multivariate estimation. Further, we would also like to test the second part this prediction: the higher liquidity maintained by the lower-dividend-paying firms will not be at the expense of operating efficiency. To test this, we use operating performance as a proxy for operating efficiencies. Following Loughran and Ritter (1997) and Hertzel et al. (2002), we measure operating

[17] This result is not fully consistent with DeAngelo and DeAngelo's (2006) theory of flexibility. They suggest that firms with low debt will have steady payouts. We do not directly test if firms with low debt are steadily paying low dividends as this is not a prediction of our model.

Table 8
Fixed effects regression

	Model 1		Model 2		Model 3	
	Dividend yield		Dividend/net income		Dividend/financial slack	
Intercept	0.0114	0.0055	0.1213	0.0025	0.6126	0.3780
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Liq	−0.0105	−0.0064	−0.0792	−0.0025	−1.0007	−0.8851
	(0.065)	(0.034)	(0.049)	(0.056)	(0.076)	(0.100)
D/E	0.0084	0.0077	0.0178	0.0178	0.0814	0.0891
	(0.001)	(0.001)	(0.042)	(0.040)	(0.113)	(0.080)
Risk	−0.0156	−0.0209	−0.3463	−0.0010	−0.0331	−0.0272
	(0.067)	(0.004)	(0.017)	(0.668)	(0.023)	(0.012)
OpPer = Op.Inc./TA	−0.0437		−0.1417		−0.9951	
	(0.001)		(0.013)		(0.001)	
OpPer = NI/TA		−0.0456		−0.1989		−1.0870
		(0.001)		(0.001)		(0.003)
Size	0.0020	0.0089	0.0173	0.0004	0.0588	0.0315
	(0.001)	(0.001)	(0.001)	(0.001)	(0.010)	(0.012)
Mktbk	−0.0000	−0.0001	0.0002	−0.0001	0.0010	0.0007
	(0.417)	(0.418)	(0.749)	(0.629)	(0.815)	(0.864)
N	5524	5524	4406	4406	5524	5524
Adjusted-R^2	13.42%	13.17%	1.20%	1.29%	0.59%	0.60%
F-statistic	115.87	113.35	10.00	10.70	5.42	5.44
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)

Fixed-effect regressions of the following equation of dividend payouts on firm characteristics for 2407 dividend-paying and non-dividend-paying firms between 1980 and 2000:

$$\text{Div} = \alpha + \beta_1 \text{Liq} + \beta_2 D/E + \beta_3 \text{Risk} + \beta_4 \text{OpPer} + \beta_5 \text{Size} + \beta_6 \text{Mktbk} + \varepsilon$$

where Div is the firm's dividend yield (Model 1), the firm's cumulative dividend standardized by net income (Model 2), or the firm's cumulative dividend standardized by cash (Model 3), Liq is the firm's cash and short-term investments divided by total assets, D/E is the firm's debt-to-equity ratio, Risk is the firm's estimate of idiosyncratic risk, OpPer is the firms operating performance (ratio of operating income to total assets or net income to total assets), Size is the log of the firm's market capitalization, Mktbk is the firm's market-to-book ratio, and ε is the ordinary least squares error. P-values are in parenthesis below coefficient estimate.

performance as the ratio of operating income to total assets and the ratio of net income to total assets.[18] To control for industry effects, we subtract the industry's median operating performance from the firm's operating performance for each year. The firm's industry is classified by two-digit SIC codes. We run the following fixed-effects multivariate regression

$$\text{Div} = \alpha + \beta_1 \text{Liq} + \beta_2 D/E + \beta_3 \text{Risk} + \beta_4 \text{OpPer} + \beta_5 \text{Size} + \beta_6 \text{Mktbk} + \varepsilon \tag{12}$$

where Div is the firm's dividend yield (Model 1), the firm's cumulative dividend standardized by net income (Model 2), or the firm's cumulative dividend standardized by financial slack (Model 3), Liq is the firm's cash and short-term investments divided by total assets, D/E is the firm's debt-to-equity ratio, Risk is the firm's estimate of idiosyncratic risk, OpPer is the firms operating performance (ratio of operating income to total assets or net income to total assets), Size is the log of the firm's market capitalization, Mktbk is the firm's market-to-book ratio, and ε is the ordinary least squares error. The firm's market-to-book ratio is included as a proxy for growth opportunities of the firm.

Table 8 presents the regression results. For Model 1 all variables are significant and have the predicted signs. The firm's D/E is positively related the dividend yield, while Liq, Risk and OpPer (both measures) are negatively related to dividend yield. The fact that operating performance is inversely and significantly related to dividend payout does not support the free-cash-flow hypothesis but is consistent with the flexibility hypothesis. Size is also significantly positive, indicating larger firms pay more in dividends. However, Mktbk is insignificant. Further, the overall regressions are significant. Model 2 yields similar results for all variables. However, the F-statistics are lower, though still significant, and the adjusted-R^2s are much lower. Finally, Model 3 produces significant results except for Mktbk. However, the adjusted-R^2 is so low that little economic significance can be inferred. Overall, these regressions support the univariate results that firms that have more flexibility pay less in dividends.

Table 9 summarizes predictions of the key variables under signaling and free cash flow, as well as results from previous studies and our results. While many of our findings are consistent with previous studies, contrary to prior research we do find that firms with less cash pay more in dividends. Further we find firms with more debt pay more in dividends. These results suggest that dividends and debt may not be perfect substitutes in solving the FCF problem. Our findings are consistent with Gabudean (2006). His study looks at firms' financial policies being determined firm specific characteristics as well as those of their rivals. He finds that

[18] Operating income is defined as Compustat item #13 plus Compustat item #62, and net income is Compustat item #172.

Table 9
Research on dividend theories

Study	Sample period	Testing dividend theory	Measure	Results	Our results
Pettit (1972)/Aharony and Swary (1980)	1964–1968/ 1963–1976	Signaling	Price change surrounding dividend changes	Price increase (decrease) after increase(decrease) announcement	Price increase (decrease) after increase(decrease) announcement
Asquith and Mullins (1983)/Healy and Palepu (1988)/ Michaely et al. (1995)	1954–1963/ 1969–1980/ 1964–1988	Signaling	Price change surrounding dividend initiations and omissions	Price increase (decrease) after initiation (omissions) announcement	
Watts (1973)/Gonedes (1978)/Penman (1983)/Brickley (1983)	1946–1967/ 1947–1970/ 1968–1973/ 1969–1979	Signaling	Examined if dividend predicted future earnings	Positive relation but low significance except for Brickley that found higher significance	
Healy and Palepu (1988)	1969–1980	Signaling	Examined if dividend initiations (omissions) predict dividend increases (decreases)	Initiations predicted higher future earnings but omissions did not predict lower earnings	
Benartzi et al. (1997)	1979–1991	Signaling	Examined if dividend predicted future earnings	No relation between dividend changes and future earnings but significant relation between dividends and past earnings	
Nissam and Ziv (2001)	1963–1998	Signaling	Examined if dividend predicted future earnings	Significant relation between dividends and future earnings after controlling for omitted correlated variables	
Bernheim and Wantz (1995)	1962–1988	Signaling	Market reaction to dividend changes during different tax regimes	Higher taxes on dividends, the market reaction is great to dividend payments	
Grullon et al. (2002)	1967–1993	Signaling	Dividend changes and changes in risk	Dividend increases (decreases) precede decline (increase) in systematic risk and ROA	Lower risk firms pay more in dividends than higher risk firms
Denis et al. (1994)	1962–1988	Signaling/ FCF	Relation between dividend changes, Tobin's *Q*, excess returns, and dividend yield	Excess returns positively related to dividend change and dividend yield but unrelated to Tobin's *Q*	No significant relation between Tobin's *Q* and dividend payouts
Lang and Litzenberger (1989)	1979–1984	FCF	Price change surrounding dividend changes conditioned on Tobin's *Q*	Low Tobin's *Q* firms have greater positive price reaction to dividend increases than High Tobin's *Q* Firms	
Yoon and Starks (1995)	1969–1988	FCF	Price change surrounding dividend changes conditioned on Tobin's *Q* and other factors	No difference in price reactions for High or Low Tobin's *Q* firms	
Grullon et al. (2002)	1967–1993	FCF	Examine changes in ROA, cash levels and capital expenditures surrounding dividend changes	Find that ROA, cash and capital expenditures all decrease after a large dividend increase	Firms with higher operating performance pay less in dividends Firms with less cash pay higher the dividends
Lie (2000)	1980–1997	FCF	Relation between excess funds and payout policy	Dividend-increasing firms had cash in excess of peer firms	Lower the cash the firm has the higher the dividend payout
Fama and French (2001)	1963–1998	Signaling/ FCF	Characteristics of dividend payers	Dividend payers have higher profitability, lower growth rates, and more assets	Firms that are larger in size and have more debt pay more in dividends

cash is negatively related to size and debt, while we find dividends are negatively related to cash and positively related to size and debt.

6. Conclusion

We develop a model of corporate dividend policy based on the idea that management will value operating flexibility when there is a possibility that shareholders will reject a profitable investment project because they overcompensate for the potential of management dressing up the project because it is not wealth maximizing and is instead personally beneficial. If the firm pays a dividend, it reduces management's flexibility to invest in projects that it believes are good but which shareholders do not. However, paying this dividend increases the current stock price of the firm. Management trades off these two aspects of dividends. Viewing dividend policy this way as an instrument of management flexibility is consistent with existing stylized facts regarding dividends and generates several new testable predictions.

We find that dividend payments are negatively correlated with stock prices, and investors value dividends more when prices are lower. Results also suggest that as the risk of the investment increases, the dividend payment decreases, and there is a positive correlation between the firm's stock price and its idiosyncratic risk. Finally, firms with low debt-to-equity ratios or high liquidity have significantly lower dividend payments than firms with high debt-to-equity ratios and less liquidity. We believe that flexibility considerations may well represent an important missing piece of the puzzle in understanding dividend policy. Yet, we believe we have only begun to explore the empirical implications of this theory.

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Appendix A

Proof of Theorem 1. Management will choose not to pay a dividend if $W(0)>W(R)$. Using the expressions for $W(R)$ and $W(0)$ from Eqs. (4) and (5) respectively, we see that:

$$W(0)-W(R)=\pi(\eta\rho[H-R]+\beta\eta\rho[R-L])-\beta\eta\rho[R-L]+(1+\beta)q\rho\tau. \tag{A-1}$$

It is clear when $\pi=1$, $W(0)-W(R)>0$, so it is optimal not to pay a dividend, and at $\pi=0$, $W(0)-W(R)\le 0$ if $\beta\eta\rho[R-L]>(1+\beta)q\rho\tau$, in which case is it optimal to pay a dividend. It is also easy to show that from Eqs. (4) and (5), when $q=0$, $W(R)=(R+V)(1+\beta)$ and $W(0)=(R+V)(1+\beta)+\pi\eta\rho[H-R]-(1-\pi)\beta\eta\rho[R-L]$, respectively. It is clear that when $\pi=1$, $W(0)-W(R)>0$.

Moreover, $W(0)-W(R)$ is differentiable in π and

$$\frac{\partial[W(0)-W(R)]}{\partial\pi}=\eta\rho[H-R]+\beta\eta\rho[R-L]>0.$$

From this it follows that $\exists\pi^*\in(0,1)$ such that $W(0)-W(R)>0$ for $\pi>\pi^*$ and $W(0)-W(R)<0$ if $\pi<\pi^*$. Solving for Eq. (A-1) as an equality, we see that:

$$\pi^*=\frac{\beta\eta\rho[R-L]]-(1+\beta)q\rho\tau}{\eta\rho[(H-R))+\beta(R-L)]}. \tag{A-2}$$

□

Proof of Lemma 1. The firm's stock price at $t=0$ if it announces $D=0$ is (see Eq. (5)):

$$P_0^s(0)=R+q\rho[H-R]+\pi\eta\rho[H-R]-\eta\rho(1-\pi)[R-L]+V. \tag{A-3}$$

Now,

$$\frac{\partial P_0^s(0)}{\partial\pi}=\eta\rho([H-R]]+[R-L])>0.$$

The firm's stock price at $t=0$ if $D=R$ is not a function of π. □

Proof of Theorem 2. It follows immediately from Theorem 1 and Lemma 1 that, conditional on the firm choosing not to pay a dividend, $P_0^s(0)$ is increasing in π. Since we know that the firm pays a dividend only if $\pi<\pi^*$, we see that

$$\overline{P_0^s}(0)=R+q\rho[H-R]+\pi^*\eta\rho[H-R]-\eta\rho(1-\pi^*)[R-L]+V. \tag{A-4}$$

For $\pi<\pi^*$, the firm will pay a dividend, so its stock price is given by

$$P_0^s(R)=R+q\rho[H-R]-q\rho\tau+V. \tag{A-5}$$

Subtracting Eq. (A-3) from Eq. (A-5), we get

$$P_0^s(R)-P_0^s(0)=-q\rho\tau-\pi\eta\rho[H-R]+\eta\rho(1-\pi)[R-L]$$

As $\pi\to 1$, $P_0^s(R)-P_0^s(0)$ becomes negative suggesting that the marginal value assigned by investors at $t=0$, to a dividend payment is higher when the stock price is lower, since the stock price is increasing in π when $D=0$. □

Proof of Corollary 1. Recall that the probability that the firm will invest in the new project is q. When $D=R$ at $t=0$, management does not have the flexibility to override the decision of shareholders, therefore, given that $D=R$, the probability of investing in the project is

$$\Phi(R)=q.$$

The probability of the firm investing in the project if $D=0$ at $t=0$ is given by the following

$$\Phi(0)=q+(1-\pi)\eta.$$

The decision (π) and the flexibility (η) parameters are probabilities and are therefore greater than or equal to zero. So that, $\Phi(R)\le\Phi(0)$. □

Proof of Theorem 3. Using the definition of π^* in Eq. (A-2), we can determine the relationship between the other parameters.

It is clear to see in Eq. (A-2) that as η increases, the denominator increases at a greater rate than the numerator, therefore, π^* is decreasing in η. This is relatively intuitive. As π^* increases, the likelihood of $\pi > \pi^*$ (which determines if the dividend will be paid in our model) decreases which ultimately decreases management flexibility (η).

Next,

$$\frac{\partial \pi^*}{\partial \beta} = \frac{\eta^2 \rho^2 [R-L][H-R] + (1+\beta) q \rho \tau}{[\eta \rho([H-R] + \beta[R-L])]^2} > 0$$

$$\frac{\partial \pi^*}{\partial \tau} = \frac{-(1+\beta) q \rho}{\eta \rho([H-R] + \beta[R-L])} < 0$$

$$\frac{\partial \pi^*}{\partial q} = 0.$$

□

Proof of Theorem 4. Using Eqs. (A-3) and (A-5) we can write:

$$P_0^s(0) - P_0^s(R) = \pi \eta \rho [H-R] - (1-\pi) \eta \rho [R-L].$$

It is clear that $P_0^s(0) - P_0^s(R) < 0$ when $\pi = 0$, which means shareholders would prefer that a dividend be paid at $\pi = 0$, and $P_0^s(0) - P_0^s(R) > 0$ at $\pi = 1$, which means shareholders would like a dividend to not be paid at $\pi = 1$. Moreover,

$$\frac{\partial \left[P_0^s(0) - P_0^s(R)\right]}{\partial \pi} = \eta \rho([H-R] + [R-L]) > 0. \qquad (A-6)$$

Thus, $\exists \pi^o \in (0, 1)$ such that shareholders would prefer that a dividend be paid if $\pi < \pi^o$ and that a dividend not be paid if $\pi^o \leq \pi$. Moreover, comparing Eqs. (A-2) and (A-6), we see that $\pi^* < \pi^o$. □

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