Payout and Investment Decisions under Managerial Discretion

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Abstract

In traditional signalling models, high-quality firms can separate themselves from low-quality firms by using their payout policy. Standard agency theory suggests that shareholders will pressure managers to pay out all excess cash in order to avoid over-investment.

If firms have different investment opportunities, and these investment opportunities are imperfectly known to investors, signalling à la Miller and Rock (1985) does not work. Moreover, since the actual amount of excess cash is difficult to determine, attempting to induce management to disburse cash can leave the firm with either too much or too little cash available for investment.

The paper examines a framework where managers’ incentives are not necessarily aligned with those of the shareholders, and where the investment opportunities of various firms are different and not known. As a result, dividends become an imperfect indicator of firm quality. Looking at payout policy from this angle allows us to explain and reconcile several empirical regularities found in the literature. The role of informed investors, active shareholders and repurchases is also discussed.
1 Introduction

In a Modigliani and Miller (1961) type of world, payout policy is irrelevant. The value of a firm is given by its investment projects, and these projects are independent of the amount of cash paid out by the firm to its shareholders.

Empirical studies and surveys have consistently shown, however, that both firm managers and investors consider payout policy to be quite important.

On the investor side, we know that announcements of dividend increases and repurchases are associated with positive and significant share price reactions, while dividend decreases are associated with significant negative reactions.

On the firms’ side, it seems that managers are far from being unconcerned with payout policy. A recent survey of US managers by Brav, Graham, Harvey and Michaely (2004) finds that most managers consider payout policy to be at least as important as investment policy. 88% of the managers in the survey say there are negative consequences to reducing dividends (confirming a pattern noticed as early as Lintner 1956). Moreover, many of them also “tell stories of selling assets, laying off a large number of employees, borrowing heavily, or bypassing positive NPV projects, before slaying the sacred cow by cutting dividends.”

The corporate finance literature has provided two main explanations for the importance of payout policy. Agency theory emphasizes the managers’ tendency to overinvest by employing excess cash in negative-NPV projects that bring them private benefits (DeAngelo, DeAngelo and Stulz 2006, Easterbrook 1984). An increase in payout is therefore good news since it reduces the free cash available to managers. Signalling models show that higher payout can be used by high-quality firms to distinguish themselves from their low-quality counterparts. Firms with less promising prospects will find it difficult to increase payout because of the cost of additional external capital (Bhattacharya 1979), of having a higher share in a bad firm (John and Williams 1985), or of reducing investment (Miller and Rock 1985).
It can be argued - as a large literature in corporate finance does - that investors have only imperfect information about the investment opportunities of various firms. Assuming imperfect information about investment projects entails some problems for the mainstream theories on dividend policy.

Agency theory implies that shareholders will pressure management to disburse excess cash. If the firm’s investment opportunities are only roughly known by investors, there is the risk that forcing management to pay high dividends, for instance, will lead to the loss of valuable investment opportunities. This is analogous to the trade-off between overinvestment and underinvestment described in the literature on capital structure (Stulz 1990).

Signalling models such as Miller and Rock (1985) rely on firms having identical investment opportunity sets. In these models, firms with higher (unobservable) current earnings can signal their quality by paying higher dividends because the opportunity cost (in terms of reduced investment) is lower in their case. However, if firms have different investment opportunities, and these investment opportunities are not common knowledge, then using payout policy to separate firms of different qualities can become difficult. A firm with less valuable investment opportunities - and hence future earnings - will find it easier to pay higher dividends than a firm with good investment opportunities. The cost of the signal is lower for the high type and dividends are no longer a perfect indicator of firm quality.

The present paper looks at payout policy when the firms’ investment opportunities are not perfectly known by investors. In this framework firms can pay higher dividends not just because they have high excess cash, but also because they have foregone valuable investment opportunities in order to boost the current share price.

While higher dividends are still associated with a higher average firm quality, the same level of dividends is adopted by firms with different prospects. Managers of firms with valuable investment opportunities weigh the relative benefits of undertaking their projects - and improving long-run performance - and those of paying higher current dividends. As a result, some valuable investment opportunities will be lost.
The loss in investment will be higher the lower the returns on investment projects, the lower the weight put by managers on future compensation, and the less widespread the investment opportunities in the economy.

Looking at payout and investment policy from this angle allows us to explain several important empirical regularities. It suggests why small firms - which are faced with the highest problems in terms of information opaqueness - often choose not to pay dividends: the opportunity cost in terms of foregone investment is usually higher in their case. This aspect is ignored if one assumes that all firms have the same production function.

Asymmetric information implies that the payout and investment policy of various firms is connected. When investment opportunities are more widespread, investors are less wary of low dividends and investment becomes more likely: there is “strength in numbers”. This mechanism sheds some light into the phenomenon of “disappearing” (Fama and French 2001) and “reappearing” (Julio and Ikenberry 2004) dividends. It also provides an explanation for the “catering” for investor preferences noted by Baker and Wurgler (2004). Indeed, while “catering” has been challenged by Hoberg and Prabhala (2004), who emphasize the importance of idiosyncratic risk, it may well be that the two competing stories describe the same feature of dividend policy.

The model considers both pure and mixed strategies available to managers. Looking at mixed strategies allows us to examine the situation of partial investment - firms decide to invest only some of the time or only some of the firms invest. The paper analyzes the factors that influence the probability of investment. It can be shown that unstable low-investment equilibria are also possible. A small “push” from investors in terms of more favorable share prices for low dividends is enough to shift the firms to higher investment and increase firm value. This may explain why investors can be happy with a dividend policy that does not distribute away all excess cash. Indeed, while large amounts of dividends are paid by firms every year - and without them agency problems would be huge (DeAngelo, DeAngelo and Stulz 2004), firms are
As we have already seen, managerial self-interest can lead to distorted investment. One may expect that there are ways to alleviate this problem by adjusting managerial incentives. The ones who can make these adjustments are existing shareholders. It is thus important to note that current shareholders may be just as interested as managers in boosting the current share price if they intend to sell their shares in the short run. Therefore the mechanism that is meant to reduce distortions may work less than perfectly. Indeed, at least theoretically, one can contemplate the situation where managers are more “conservative” (i.e., more willing to invest) than shareholders themselves.

Introducing informed investors to the model reduces distortions, since prices will be more closely aligned to the true value of each firm. However, the distortions are not necessarily eliminated. This is because - unless they aim to take control of the firm and force the management to make the right decisions - informed investors are interested in potential trading profits. The main source of these profits is the variability in firm values, not the increase firm value, which is shared with uninformed investors. Since firms that pay excessive dividends are overpriced in the model, the paper provides a tentative explanation for the mismatch between the empirical findings of Grinstein and Michaely (2005) and the implications of the model in Allen, Bernardo and Welch (2000).

The remainder of the paper is structured as follows: Section 2 presents a brief overview of the dividend literature, Section 3 presents the basic model in the case of uninformed investors, Section 4 introduces potentially informed investors, and Section 5 concludes.

2 Literature review

In a Miller and Modigliani (1961) type of world, dividends are irrelevant. The value of the firm is given solely by its investment opportunities, and dividends are just the residual. Firms can attract additional funds at the appropriate cost, and investors
faced with consumption shocks can get their own “homemade dividends” by selling some of their shares.

We know however that dividend increases and decreases are associated with significant share price reactions (Aharony and Swary 1980, Denis, Denis and Sarin 1994, Nissim and Ziv 2001). It seems therefore that investors interpret higher dividends as signs of higher firm quality. Researchers have tried to explain this stylized fact based on departures from the Miller and Modigliani framework. Dividends can alleviate agency problems by reducing the free cash flow available to managers and keeping firms in the capital markets (Easterbrook 1984, DeAngelo, DeAngelo and Stulz 2005). At the same time, dividends can benefit shareholders at the expense of debtholders although this conflict does not seem to be very important in practice (Handjicinicolou and Kalay 1984). Signaling models argue that dividends are costly - and therefore credible - indicators of firm quality (Bhattacharya 1979, John and Williams 1985, Miller and Rock 1985, Allen, Bernardo and Welch 2000). Dividend clienteles (Bajaj and Vijh 1990, Allen, Bernado and Welch 2000) and behavioral features (Shefrin and Statman 1984) have also been put forward as explanations of dividend policy.

Empirically, results on the various theories have often been mixed. Lang and Litzenberger (1989) and DeAngelo, DeAngelo and Stulz (2004) show the importance of agency problems in dividend policy. Denis, Denis and Sarin (1994) and Yoon and Starks (1995), however, reject the claims of Land and Litzenberger (1989) and favor signaling explanations for dividends. The relationship between dividends and earnings - as implied by signaling models - has been (sometimes weakly) supported by Penman (1983), Nissim and Ziv (2001) and challenged by Benartzi, Michaely and Thaler (1997) and Grullon, Michaely, Benartzi and Thaler (2005). Grullon, Michaely and Swaminathan (2002) suggest that dividend changes contain information about risk rather than about future earnings (the “maturity hypothesis”). The importance of taxes is also a matter for debate (Bernheim and Wantz 1995, Michaely and Murgia 1995, Hubbard and Michaely 1997, Amihud and Murgia 1997).

The proportion of dividend-paying firms tends to fluctuate over time. Fama and French (2001) show that the propensity of firms to pay dividends decreased significantly

Baker and Wurgler (2004) show that the propensity to pay dividends is related to the difference in the market-to-book ratios of dividend-paying and nonpaying companies. Their “catering” theory argues that investors prefer dividends more in some periods than in others and that firm managers respond to these preferences. Hoberg and Prabhala (2005) dispute this and show that after controlling for idiosyncratic risk the indicator of investor preferences has no additional explanatory power.

Allen, Bernardo and Welch (2000) connect the idea of tax clienteles with that of signaling/monitoring. Higher dividends imply higher tax costs for individual investors, but not for institutional ones. Since institutional investors are better monitors or are simply better at identifying good firms, dividends can be used to separate firms of different quality and higher dividends will be associated with higher institutional shareholdings. Grinstein and Michaely (2005) however find that, while institutional investors are more likely to invest in dividend-paying companies, there is actually a weakly negative relationship between the size of dividend payments and institutional ownership.

The usual signaling models imply that firm quality can be clearly distinguished based on the dividends they pay. Departing from idea that dividends are perfectly correlated with firm quality allows us to get a more nuanced and likely more realistic picture of dividend policy. Kumar (1988) also builds a model where dividends are only rough indicators of earnings. The existence of the coarse equilibrium - and the non-existence of the pure signalling equilibrium - is generated by the different risk aversion of managers and shareholders. In the current model, agents are risk-neutral and the main problem is that of asymmetric information.

3 The Model

Potential investment opportunities are one of the most difficult elements to assess by the outside investors in a firm. In a world where all firms have the same investment
opportunities, dividends can be used as a precise signal for the firm's current (and potentially future) earnings - as shown in Miller and Rock (1985). Since firms have the same source of costs and benefits from dividend payments, firms with higher earnings will be able to pay higher dividends and distinguish themselves from firms with lower earnings.

If firms have different investment opportunities (and these opportunities are difficult to assess by outside investors), dividends become an imperfect indicator of a firm’s future prospects. Firms that pay lower dividends because they decide to invest in positive NPV projects face the risk of being pooled with low-paying firms that do not have valuable growth opportunities. At the same time, deciding not to invest in some positive-NPV projects will leave the firm with more cash available for paying dividends. While the long-term prospects of the firm will be affected, the current share price of the firm will be relatively high.

Foregoing potentially valuable investment opportunities is obviously inefficient from a social point of view. However, the compensation of a firm’s management is often tied to the share price and managers thus have an obvious incentive to boost the current share price. This particular behaviour may not be so strongly opposed by shareholders - especially if a large share of them expect to have to sell their shares in the near future.

It can be argued that the managers’ (and shareholders’) time horizon is not extremely short and that important and visible positive NPV investment projects will be undertaken. The incentive to distort the firm’s investment policy in order to increase the current share price will be higher if

- the investment project is less “visible”/more difficult to assess by outside investors. A large investment in physical assets will be much more visible than small diffuse measures that increase the operating efficiency of existing processes within the firm. Some projects - for instance the research for new drugs or new software products - may be difficult to evaluate by the ordinary private investor.
- the firm is large/diversified and has many different investment opportunities in various areas;
- the firm’s shares are held by many small investors. These investors may not have
the expertise to assess the prospects of the various investment projects. Their shareholdings may also be too small to provide them with the incentive to monitor the firm very closely.

The vast majority of dividends tend to be paid by large firms (DeAngelo, DeAngelo and Skinner 2004). With a few exceptions, these firms are widely held. The market in their shares is quite liquid. Moreover, the number of potential investment projects for these firms is quite high, and it may be difficult for the investors to get a precise picture (this in spite of having a larger number of analysts following these firms).

3.1 The Case of Uninformed Investors

3.1.1 The basic setup

The model has two main types of firms:

- firms that have valid growth opportunities;
- no-growth firms that produce a constant cash flow every period.

Managers know the type their firm belongs to; the firms’ shareholders, as well as outside investors, however, are unable to evaluate each firm’s growth opportunities. They only know the proportion of each type of firm in the total population. Current dividends are by definition a “free” piece of information that can easily be used by any investors.

Both investors and managers are risk-neutral. Both groups also discount future cash flows, possibly at different rates.

There are large numbers of firms of each type. As a result, if a firm with a valid investment project decides to undertake the project and pay lower dividends, there will be at least some no-growth firms with the same level of dividends. If the project is not undertaken and the firm can pay higher dividends, there will again be no-growth firms that pay the same amount.

More precisely, if the firm undertakes the investment project, it will be able to pay $d$ in the first period and $D' > d$ in the second period. There will be other, no-growth
firms that also pay $d$ both in the first and the second period. If the manager decides to forgo the investment opportunity, the dividend will be $D > d$ at $t = 1$ and $d$ at $t = 2$.

There are also no-growth firms that pay dividends equal to $D$ in both periods.

Investment is supposed to be efficient from a social point of view - the “true” value of the firm is higher if the project is undertaken. The condition that expresses this is

$$d + \delta D' > D + \delta d.$$ 

One could also consider the (simpler) case where the firms with growth opportunities that do not invest pay equal dividends in both periods. However, the extra cash on the balance sheet is likely to be easily observable by shareholders and they will ask for higher dividends in order to avoid free cash flow problems. Cash flows next period are likely to be lower due to the lack of investment, and - without cash reserves from the previous period - the dividends will follow suit. Existing empirical evidence also appears to lend support to this assumption. Grullon, Michaely and Swaminathan (2002) find that dividend increases follow periods of high growth in capital expenditures, while dividend decreases follow sharp declines. Another reason why unequal payments is the more interesting option is given in the following subsection. For simplicity, the lowest level of dividends in the model ($d$) will be usually normalized to 0.

The proportion of firms with growth opportunities in the total population is $\beta$, while the proportions of no-growth firms paying $d$ and $D$ respectively are equal to $\alpha$ (thus $2\alpha + \beta = 1$). While investors do not know the precise growth opportunities of each individual firm, they are aware of the overall distribution of growth opportunities - that is, they know $\alpha$ and $\beta$. Dividends after $t = 2$ are assumed to be constant and equal to $C$ for all firms (the assumption here is that neither managers nor investors can produce a very precise and differentiated dividend forecast far into the future).

The three groups of firms and their dividends are illustrated in Figure 1.

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1There is also a well-documented negative relationship between growth opportunities (measured by the market-to-book ratios and asset growth rates) and dividend payments (see for instance Fama and French 2001, DeAngelo, DeAngelo and Stulz 2004, Hoberg and Prabhala 2005). One should note, however, that this finding concerns growth opportunities as perceived by the market/past growth rates, while the model deals with growth opportunities that are not widely known by investors.
Figure 1: The decision problem of firms with growth opportunities

At $t = 1$, managers decide on the dividend and investment policy, and firms pay the first round of dividends. Investors observe the dividends announced by each firm and share prices are formed as the discounted sum of future dividends:

$$P_1 = \text{Div}_1 + \delta \text{Div}_2 + \delta^2 \frac{C}{1 - \delta}$$
where \( \text{Div}_1 \) are dividends paid in the first period, \( \text{Div}_2 \) are the (expected) dividends paid in the second period, and \( \delta \) is the discount factor for future cash flows.

The managers’ compensation consists of a bonus proportional to the current share price that is paid each period. \(^2\) Managers discount future compensation at the rate \( m \). Thus the managerial payoff can be written as:

\[
\text{Payoff} = P_1 + mP_2 + m^2 \frac{C}{(1 - m)(1 - \delta)},
\]

where \( P_t \) is the share price at time \( t \).

To sum up, the structure of the basic model is as follows:

1. At \( t = 1 \), the managers of firms with growth opportunities decide whether to undertake the project. Investors observe dividends and prices are formed on the market. Managers are then compensated based on the market value of the firm.

2. At \( t = 2 \), the next round of dividends is revealed, new prices are formed and managers receive their new compensation. The process will be repeated over future periods.

### 3.1.2 Results

Investors will use the dividends announced by each firm in order to form the share prices. Since the actual growth opportunities of each firm are unobservable, investing firms that pay dividends \( d \) at time \( t = 1 \) will be pooled with no-growth firms paying the same amount. Firms that forgo investment and pay high dividends \( D \) will also be pooled with firms with constant dividends. The share price of each group will reflect

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\(^2\)Alternatively - and in line with many existing models - one could assume that managers derive fixed private benefits from their position each period and that keeping this position each period depends on raising the value of the firm above a fixed threshold given by the value of the firm under alternative management. A higher value of the firm will increase the perceived probability that the manager’s abilities are high and will make dismissal less likely - thus the manager will be able to continue enjoying private benefits. The mechanics of the model in this case are similar.
the average value of the firms included in the pool. This quality will be affected by the managers’ investment decisions, which in turn are guided by the resulting share prices and their effect on compensation. We consider both pure and mixed strategies for the managers - they can always invest, invest with probability \( p \) or never invest.

If managers decide to invest with probability \( p \) (where \( p \) can also be 0 or 1), the market value at \( t = 1 \) for a firm paying dividends equal to \( d \) will be:

\[
P^d_1 = d + \delta \frac{\beta p D' + \alpha d}{\beta p + \alpha} + \delta^2 \frac{C}{1 - \delta}.
\]

In the case of a firm that pays \( D \), the value will be

\[
P^D_1 = D + \delta \frac{\beta (1 - p)d + \alpha D}{\beta (1 - p) + \alpha} + \delta^2 \frac{C}{1 - \delta}.
\]

For firms with growth opportunities that invest, the price at \( t = 1 \) will be given by

\[
P^d_2 = D' + \delta \frac{C}{1 - \delta},
\]

while for firms that do not invest the price will be

\[
P^D_2 = d + \delta \frac{C}{1 - \delta}.
\]

From \( t = 3 \) onwards, the price (at least as seen from \( t = 1 \)) will be equal to \( \frac{C}{(1 - \delta)} \).

As we have already mentioned, the manager’s payoff function is given by:

\[
\text{Payoff} = P_1 + mP_2 + m^2 \frac{C}{(1 - m)(1 - \delta)}.
\]

The payoff for investing firms will be

\[
\text{Payoff}^d = d + \delta \frac{\beta p D' + \alpha d}{\beta p + \alpha} + \delta^2 \frac{C}{1 - \delta} + mD' + m\delta \frac{C}{1 - \delta} + m^2 \frac{C}{(1 - m)(1 - \delta)}.
\]

while for firms that do not undertake their projects it will be

\[
\text{Payoff}^D = D + \delta \frac{\beta (1 - p)d + \alpha D}{\beta (1 - p) + \alpha} + \delta^2 \frac{C}{1 - \delta} + md + m\delta \frac{C}{1 - \delta} + m^2 \frac{C}{(1 - m)(1 - \delta)}.
\]
In a mixed strategy equilibrium (where investment occurs with probability $p$) managers will be indifferent between the two alternatives. Defining the function $H$ as the difference between the payoffs with and without investment,

$$H = \text{Payoff}^d - \text{Payoff}^D = d + \delta \frac{\beta p D' + \alpha d}{\beta d + \alpha} + mD' - D - \delta \frac{\beta (1 - p)d + \alpha D}{\beta (1 - p) + \alpha} - md,$$

a mixed strategy equilibrium will require $H = 0$. One can also have the pure strategy equilibria of no investment (when $H(p = 0) \leq 0$) and full investment (when $H(p = 1) \geq 0$).  

A first look at the expression for $H$ - that is, for the difference in the rewards of investing and shirking - allows us to outline to conditions that favor investment:

**Proposition 1.** The incentives to invest increase if

- the returns on investment (proxied for instance by $D'/D$) are higher;
- the managers care more about the future ($m$) are higher;
- investment opportunities are more widespread ($\beta$ is higher).

**Proof** See Appendix.

The first two conclusions are intuitively obvious. The last one, however, is more interesting. It says that firms will find it more attractive to invest - and pay lower dividends - if the proportion of firms having worthwhile projects is higher. This is because having more “growth” firms in the high dividend group will depress the price, while having more “growth” firms in the low dividend group will increase it. An increase in the general population of firms that have new positive NPV projects will

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3As one can see, the probability of investment - $p$ - appears both in the numerator and the denominator of the ratios included in $H$. This is because - unlike in other models that focus on mixed strategies, such as Maug (1998) - the randomizing probability chosen by the agent also changes the value of the “average” firm. If more firms decide to invest ($p$ increases), then the value of the average firm paying low dividends increases. At the same time, the value of firms paying high dividends also increases - because there are fewer “shirking” firms in the pool. If fewer firms decide to invest, then the value of low-dividend firms decreases, as well as the value of high-dividend firms. These simultaneous movements mean that we have to analyze in some detail the existence of various equilibria.
thus most likely make conditions more favorable for investment - there strength in numbers.

Indeed, we know that positive share price reactions to dividend increases are larger in declining markets (when investors most likely become aware that growth opportunities have become scarcer) (Fuller and Goldstein 2005). This means that the “reward” for high dividends is decreasing in $\beta$, as implied by our model.

Note. One can also assume that at the “upper” and “lower” ends - that is, at the dividend levels $D$ and $d$ - one has additional firms with growth opportunities, for which $D$ and $d$ represent the initial levels of dividends in the case of investment and shirking respectively. However, adding them and taking their strategies as given in order to determine the equilibrium would only add some constant terms on the both sides of the tradeoff represented by means of $H$. It would however change things if one were to consider the simpler case where shirking firms pay equal dividends in both periods. This one additional reason why the more complicated case of different dividends is considered in the paper.

We now have to analyze the investment equilibria and the circumstances when they occur. To simplify things and provide a better intuition, we normalize $d$ (the lowest level of dividends) to 0 and define $k = D'/D$. $k$ therefore stands for the returns on the investment project. Investment is worthwhile (as we have assumed) if $k > 1/\delta$. It should be noted that our model allows us to distinguish between the average profitability of individual investment projects (proxied by $k$) and the abundance of these projects (proxied by $\beta$).

The structure of possible investment equilibria depends on the returns on investment $k$.

**Proposition 2.** If returns are relatively high ($k > \left(1 + \frac{\beta}{\alpha}\right)^2$), then

• If
there is a mixed strategy equilibrium with partial investment, as well as the equilibrium of full investment. The mixed strategy equilibrium is however unstable.

- If

\[
k \left( \frac{\delta \beta}{\beta + \alpha} + m \right) > 1 + \delta
\]

\[
mk < 1 + \frac{\alpha \delta}{\alpha + \beta}
\]

there is only a pure strategy equilibrium (always invest).

Proof See Appendix.

The possible equilibria in the case of high returns can be seen in Figure 2.

If returns are high, conditions are reasonably favorable to investment. The more interesting case is that of projects with relatively low returns. Indeed, if investment returns are high, one could imagine that the managers could contact a financial intermediary and obtain the necessary funds; they would not have to resort to cutting dividends for this. However, if the returns on investment are lower (but still positive), the additional costs of financial intermediation may make this option unfeasible.

Proposition 3. If \( k < (1 + \frac{\beta}{\alpha})^2 \):

- If

\[
k \left( \frac{\delta \beta}{\beta + \alpha} + m \right) > 1 + \delta
\]

\[
mk > 1 + \frac{\alpha \delta}{\alpha + \beta}
\]

there is only one pure strategy equilibrium (always invest).
one can have both pure strategy equilibria (always invest and never invest), and an unstable mixed strategy equilibrium with partial investment.

- If

\[
k \left( \frac{\delta \beta}{\beta + \alpha} + m \right) > 1 + \delta
\]

\[
mx < 1 + \frac{\alpha \delta}{\alpha + \beta}
\]

and \( H(p = \frac{3k + \alpha k + \alpha - \sqrt{k}}{\beta(k - 1)}) > 0 \), then there are two mixed strategy equilibria, as well as the pure strategy equilibrium of no investment (which gives the manager a lower expected payoff than either of the mixed equilibria with partial investment).

Proof See Appendix.

The possible equilibria in the case of low returns can be seen in Figure 3.
Figure 2: Possible equilibria for high returns $k$. Upper graph: full investment is always optimal. Lower graph: both full investment and no investment can arise.
The multitude of possible equilibria warrants explanation. The first case will occur...
when returns are relatively high, managers are also interested in future compensation, and investment opportunities are more widespread ($\beta$ is higher). Rather unsurprisingly, we get the equilibrium with the highest $p$ when conditions are most favorable to investment.

The two following cases are more interesting. The apparently more persistent equilibrium (the one that appears in both cases and that is actually a continuation of the mixed equilibrium in Proposition 2) is actually unstable. That is, if investors make a small mistake in setting prices and make them more or less favorable to investment, managers will follow suit by increasing/decreasing the probability of investment and the whole system will move towards an alternative equilibrium.

The existence of this unstable and Pareto-dominated equilibrium is actually important. It represents the case when firms can “get stuck” in a low-investment equilibrium and pay high dividends lest they be considered of inferior quality. This is obviously unsatisfactory since it destroys firm value. A small “push” from investors in terms of share prices more favorable to investment - that is, relatively higher prices for low dividends - will cause a switch to an equilibrium where positive fewer positive NPV projects are lost. This may well be explain why - while there obviously is a pressure for managers to disgorge cash (DeAngelo, DeAngelo and Stulz 2004) - investors do seem to be happy with “niggardly” (Miller and Modigliani 1961, DeAngelo and DeAngelo 2006) payouts.

The second mixed strategies equilibrium - which implies a higher probability of investment that the previous one and thus a higher average firm value - is the stable one \(^4\). In the case of small perturbations managers will tend to move back to the equilibrium. This is the most interesting case for analysis. It is the situation when full investment is not sustainable, because returns are too low or managers are less interested in future compensation (for instance, if they are closer to retirement). This

\[^4\text{The stable mixed equilibrium exists if } H(p_1) > 0 \text{ - that is, if}
\]

$$k(\delta + \delta \alpha + m) - 2\alpha \delta \sqrt{k} - \alpha \delta - 1 > 0$$

Even if $m = 0$ (managers do not care about the future), this is an equilibrium for high enough $\beta$. Thus some investment is sustainable even in adverse conditions if investment opportunities are widespread enough.
is the equilibrium that will form the focus of the remainder of this section and the following section of the paper.

We can now present some comparative statics results for the mixed strategy equilibrium.

**Proposition 4.** The probability of investment \( p \) is

- increasing in the investment returns \( k \) (\( \partial p / \partial k > 0 \));
- increasing in the managerial discount factor for future compensation \( m \) (\( \partial p / \partial m > 0 \));
- increasing in the proportion of firms with valuable growth opportunities (\( \partial p / \partial \beta > 0 \)).

*Proof* See Appendix.

The final relationship - that between \( p \) and \( \beta \) - is the most interesting one. We have already seen in Proposition 1 that having more widespread growth opportunities creates better conditions for investment. This is confirmed here: the likelihood of investment is increased if growth opportunities are more widespread. This connection is useful in providing an explanation for several empirical findings.

Fama and French (2001) document that the propensity of US-listed firms to pay dividends decreased significantly during the 1990s. At the same time, Julio and Ikenberry (2004) show an increase in the number of dividend payers since 2000. One may well think that when growth opportunities were quite widespread - in the 1990s, during one of the longest periods of continuous economic growth in US history - lower dividends were a natural consequence, accepted by investors. As recession ensued and growth opportunities were largely perceived to have decreased there was a rebound in dividend payments.

They conclude that during some intervals, investors prefer high growth companies (low-dividend) companies; in other intervals, they look for “safe”, high-dividend companies - and that managers respond to these preferences. The model presented in the current paper shows that this is actually the result of rational behavior on the part of both investors and shareholders.

Hoberg and Prabhala (2005) challenge the message of the paper by Baker and Wurgler (2004). They show that when idiosyncratic risk is controlled for there is little explanatory power left for the measure of investor preferences. Our results imply that there may be truth in the claims of both sides. As growth opportunities become more widespread, investors rationally show a higher tolerance for lower dividend payments, and the ratio of market-to-book measures will shift accordingly. At the same time, there are more valid investment projects around and more of them are undertaken - and this may well increase risk, as noted by Hoberg and Prabhala (2005).

A final important thing to note about the equilibrium is that the initial price for high-dividend firms \( \left( P_{1}^{D} \right) \) is larger than the price for low-dividend firms \( \left( P_{1}^{d} \right) \). Thus, although the starting point of the model is that high dividends can be “bad” and low dividends can be “good”, in equilibrium one does not get the rather counterintuitive result of firms that pay higher dividends and command lower prices.

If all investors are uninformed, then repurchases work exactly the same way as dividends. If the underpriced higher-quality firms decide to use repurchases, their order can be matched by the order of low-quality firms, since the cash reserves of the two types of firms are identical and no investor is able to distinguish between the two types. The price of shares repurchased on the market will therefore be identical for the two groups of firms.

---

5This can be easily seen by comparing the conditions for \( H = 0 \) and \( P_{1}^{D} = P_{1}^{d} \). The prices are only equal in the extreme case of \( m = 0 \) - i.e., the manager does not care at all about the future
3.2 Introducing Informed Investors

The previous section has assumed that investors are unable to acquire information about the investment opportunities available for each particular firm. One can imagine however that at least some investors will have the ability and the incentives to obtain more accurate information about the true quality of the firms. This section deals with the case where informed investors acquire costly information about the actual state of the particular companies and use it on the market.

Two new players are added to the model. One of them is a monopolistic informed investors along the lines of Kyle (1985). This investor can obtain information at a fixed cost $c$ per firm. The other is the risk-neutral, competitive market maker.

At $t = 1$ a share $x$ of the firm is owned by the potentially informed investor and the remaining part is owned by a continuum of small investors. With probability $\frac{1}{2}$ small investors are faced with a liquidity shock at $t = 1$ and have to sell $\phi$ of their shares. Therefore the total expected proportion of shares brought by uninformed investors on the market for each firm is $\frac{1}{2}\phi(1 - x)$. Unlike the small uninformed investors, the large investor is not subject to liquidity shocks.

At time 1, managers decide on their investment and dividend policy. Once dividends are announced, the large investor decides whether to monitor. Shares are then traded on the market. Both the informed investor and the uninformed investors that face a liquidity shock submit their orders. The market maker observes the order flow and sets the price so as to break even. The manager receives the compensation based on the initial share price. At time 2, the new dividend is paid out, the new price is formed, and the management and the shareholders receive their final payoffs.

The model assumes that the potentially informed investor is unable or unwilling or unable to take over the firm and enforce the first-best investment policy. This assumption is most likely to hold if the firm is large. Admati, Pfleiderer and Zechner (1994) illustrate the limitations of large shareholder activism.

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6 The market setting is similar to that in Kyle (1985) and Maug (1998).
Monitoring provides the informed investor with the opportunity to realize trading gains. She will sell the shares of overvalued firms and buy those of undervalued firms in each “pool”. However, the trading gains will only materialize if the market maker is unable to distinguish between the order flows generated by informed and uninformed investors. The informed investor will therefore have to “camouflage” her orders. This can be achieved by buying shares of undervalued companies when a liquidity shock occurs and selling shares of overvalued companies where shareholders were not faced with a liquidity shock. If the amounts to be bought and sold are $x_B$ and $x_S$, the relationship that has to be satisfied is

$$x_b + 0 = x_S + \phi(1 - x)$$

As in Maug (1998), we consider the symmetric case where $x_b = -x_s = \frac{1}{2}\phi(1 - x) \equiv u$. Taking values of $x_B$ and $x_S$ that are not equal in absolute value does not change the essence of the main results.

The informed investor decides to monitor with probability $q$ firms that pay high dividends and with probability $s$ firms that pay low dividends. The possible market outcomes are presented in Table 1.

[INSERT TABLE 1 ABOUT HERE]

**Proposition 5.**

- Monitoring high-dividend firms is worthwhile if

$$\frac{1}{2}\phi(1 - x)\delta\alpha\beta q \frac{D - d}{(\beta(1 - p) + \alpha)^2} > c$$

- Monitoring low-dividend firms is worthwhile if

$$\frac{1}{2}\phi(1 - x)\delta\alpha\beta p \frac{D' - d}{(\beta p + \alpha)^2} > c$$

**Proof** See Appendix.

Thus monitoring becomes more attractive if shares are more liquid ($\phi$ is higher), the share of the firms owned by the uninformed investors is larger, the discount factor $\delta$ is higher (i.e., the market puts higher weight on future cash flows), and the higher
the gap between the actual cash flows of undervalued (investing) and overvalued (no-
growth) firms \((D' - d)\). Analogous relationships hold for the group of high-dividend firms.

Depending on the parameter values, we can have the situation where just the high-
or low-dividend groups are monitored, when neither of them is monitored or when both
of them are attractive to the informed investor.

Now that we have the outline of the possible market outcomes, we can reconsider
the dividend and investment choices of firm managers. If the low- and high-dividend
groups are respectively monitored the expected initial prices for investing/ shirking
managers are:

\[
E(P_{invest}^1) = d + \frac{1}{2} \delta D' + \frac{1}{2} \frac{\beta p D' + \alpha d}{\beta p + \alpha} + \delta^2 \frac{C}{1 - \delta}
\]

\[
E(P_{noinvest}^1) = D + \frac{1}{2} \delta d + \frac{1}{2} \frac{\alpha D + \beta (1 - p) d}{\alpha + \beta (1 - p)} + \delta^2 \frac{C}{1 - \delta}
\]

One can see that prices are brought more in line with the actual values of individual
firms. This suggests that managers will have higher incentives to invest. This is shown
by summarizing for instance the managers’ tradeoff when both types of firms are
monitored:

\[
\text{Payoff}_{\text{invest}} = d + \frac{1}{2} \delta D' + \frac{1}{2} \frac{\beta p D' + \alpha d}{\beta p + \alpha} + \delta^2 \frac{C}{1 - \delta} + mD' + m\delta \frac{C}{1 - \delta} + m^2 \frac{C}{(1 - m)(1 - \delta)}
\]

\[
\text{Payoff}_{\text{noinvest}} = D + \frac{1}{2} \delta d + \frac{1}{2} \frac{\beta (1 - p) d + \alpha D}{\beta (1 - p) + \alpha} + \delta^2 \frac{C}{1 - \delta} + mD + m\delta \frac{C}{1 - \delta} + m^2 \frac{C}{(1 - m)(1 - \delta)}
\]

\[
H = \text{Payoff}_{\text{invest}} - \text{Payoff}_{\text{noinvest}} = d + \frac{1}{2} \delta D' + \frac{1}{2} \frac{\beta p D' + \alpha d}{\beta d + \alpha} + mD' - D - \frac{1}{2} \delta d - \frac{1}{2} \frac{\beta (1 - p) d + \alpha D}{\beta (1 - p) + \alpha} - md
\]

The payoff for investing increases, while the payoff for not investing decreases, and
thus in equilibrium we will have \(H = 0\) for a higher value of \(p\) \((H\) is decreasing around
the equilibrium point).

It may be important to note however that even the presence of full monitoring may not be enough to switch firms from the no-investment equilibrium to partial or full investment. If this happens, monitoring costs are wasted from a social point of view. This is because - as noted in Maug (1998) - the informed investor makes profits from trading with uninformed investors. The source of these trading profits is the variability in firm value within each pool that is given the same price by the market maker; it is not the increase in the average value of the firms which is the direct consequence of higher investment but which is shared with uninformed investors.

The model shows that if a firm that has valid investment project and decides to pay high dividends rather than undertake the project informed investors will tend to sell their shares in the firm. At the same time firms that pay low dividends and invest will attract informed investors. Thus the relationship between dividends and informed/institutional investor ownership runs in the opposite direction compared to the mechanism in Allen, Bernardo and Welch (2000). Countervailing effects of this type may explain the weakly negative relationship found empirically by Grinstein and Michaely (2005).

Introducing repurchases in the presence of informed investors can help reduce the consequences of informational asymmetries. Informed investors will tender their shares in overpriced companies and - if “camouflage” is possible - buy shares in the underpriced ones. This mechanism can provide an explanation for another finding in Grinstein and Michaely (2005): institutional investors seem to have a preference for firms that use repurchases. However, in the context of our model, one can show that uninformed investors will never tender their shares in an open market repurchase, and this can restrict the shareholder base of firms that use repurchases exclusively.

The intuition here is that, since uninformed investors cannot distinguish between firm types, they will be the only one to tender their shares in the case of underpriced firms and they will share with the informed investors the trading profits from tendering in the case of overpriced firms. The intuition is similar to that in Brennan and Thakor (1990), although the market model is different.
4 Managerial Compensation

A final remark is in order. The paper has focused on managerial incentives and their effects on dividend policy. It is important however to outline as well the goals of existing shareholders and examine their interplay with those of managers and potential investors.

One can think of an existing shareholder as being faced with possible liquidity shocks in the future - or having to sell shares in the case of any other contingent event. That particular shareholder will be interested in the share price at the time where the sale occurs. If the probability of having/ intending to sell shares at time $t$ is $p_t$, then the shareholder will maximize the payoff function

$$\text{Payoff}^{\text{shareholder}} = p_1 P_1 + p_2 P_2 + p_3 P_3 + ...$$

where $\sum p_t = 1$.

This payoff structure is similar to that of managers, which was, as we have seen,

$$\text{Payoff} = P_1 + m P_2 + m^2 P_3 + ...$$

Thus it may well be that the managers’ incentives are aligned with those of the “average shareholder”, depending on shareholders’ ability to tailor managerial compensation. (Variations are of course possible and they can be examined within the framework of the model.) If the turnover of the shares is high, and shareholders only hold their shares for short intervals, shareholders may be less than willing to push management to achieve full investment at the cost of low dividends.

One may even envisage the situation when managers are more investment-friendly than the average shareholder (this time in the case of positive NPV projects...) - while at the same time both groups of firm insiders may be far from following the “social” optimum.
5 Summary and Conclusions

The paper has outlined a model that examines the managers’ dividend and investment decision when firms have different investment opportunities and these investment opportunities are not observable by at least some of the investors. Unlike in Miller and Modigliani (1961), the dividend and investment decisions are given equivalent importance and are made simultaneously. This is arguably the practice of “real-life” managers (Lintner 1956, Brav et al. 2004). Managers are not a mere representative of the average shareholder and may have their own, rather distinct, objectives.

Given the imperfect information about investment opportunities, managers have to trade off the benefits of future cash flows and dividends provided by valuable investment projects and the costs of depressing the current share price. Firms paying the same level of dividends are pooled. Although higher dividends mean higher average firm quality, dividends do not reflect the exact value of each firm and investment is in general suboptimal.

The results of the model can help explain the existence of partial dividend payments (DeAngelo and DeAngelo 2006) even if overall dividends do broadly fulfil their role in reducing agency problems. One may also be better equipped to explain the waves of “disappearing” and “reappearing” dividends, and to understand the debate between supporters of the catering explanation and those of idiosyncratic risk. Moreover, one can understand the limits of arbitrage by (existing or potential) informed minority shareholders and the factors that influence the relationship between dividends and informed shareholdings.

References


[16] Harry DeAngelo, Linda DeAngelo, René M. Stulz - Dividend Policy, Agency Costs, and Earned Equity, working paper, Jun 2004


Proof of Proposition 1

Supposing that firms that have investment opportunities invest with probability \( p \), the price at \( t = 1 \) will be:

- for firms that decide to invest and pay an initial dividend \( d \):

\[
P_1^d = d + \delta \frac{\beta p D' + \alpha d}{\beta p + \alpha} + \delta^2 \frac{C}{1 - \delta}.
\]

- for firms that decide not to invest and pay a high dividend \( D \) in the case of a firm that pays \( D \):

\[
P_1^D = D + \delta \frac{\beta (1 - p) d + \alpha D}{\beta (1 - p) + \alpha} + \delta^2 \frac{C}{1 - \delta}.
\]

At \( t = 2 \), the cash flow from investment is realized and prices are adjusted accordingly. The shares of firms that have invested at \( t = 1 \) will have a cum dividend price equal to

\[
P_2^d = D' + \delta \frac{C}{1 - \delta},
\]

while the shares of firms that have not invested will be valued at

\[
P_2^D = d + \delta \frac{C}{1 - \delta}.
\]

From \( t = 3 \) onwards, the price will be equal to \( \frac{C}{(1 - \delta)} \). (This is the price as seen from \( t = 1 \), by either the investors or the managers. It is assumed that managers do not have significantly better information than outside investors for the very long run.)

Given that the manager’s payoff function is given by the discounted sum of future bonuses,

\[
\text{Payoff} = P_1 + m P_2 + m^2 \frac{C}{(1 - m)(1 - \delta)}.
\]

the payoff for the managers of firms that decide to invest will be given by

\[
\text{Payoff}^d = d + \delta \frac{\beta p D' + \alpha d}{\beta p + \alpha} + \delta^2 \frac{C}{1 - \delta} + m D' + m \delta \frac{C}{1 - \delta} + m^2 \frac{C}{(1 - m)(1 - \delta)}.
\]
while the payoff for firms that decide not to invest is given by

\[
\text{Payoff}^D = D + \delta \frac{\beta(1-p)d + \alpha D}{\beta(1-p) + \alpha} + \delta^2 \frac{C}{1-\delta} + md + m\delta \frac{C}{1-\delta} + m^2 \frac{C}{(1-m)(1-\delta)}.
\]

In a mixed strategy equilibrium (where managers of firms with investment opportunities decide to invest with probability \(p\)), \(\text{Payoff}^d = \text{Payoff}^D\). That is, if one defines

\[
H \equiv \text{Payoff}^d - \text{Payoff}^D = d + \delta \frac{\beta p D' + \alpha d}{\beta d + \alpha} + mD' - D - \delta \frac{\beta(1-p)d + \alpha D}{\beta(1-p) + \alpha} - md,
\]

in a mixed strategy equilibrium \(H = 0\). The pure-strategy equilibria can be characterized as follows:

- full investment if \(H(p = 1) \geq 0\);
- no investment if \(H(p = 0) \leq 0\).

\(H\) provides a measure of incentives to invest - the higher \(H\), the higher the probability of investment. It can easily be checked that \(\partial H/\partial k > 0\) (where \(k \equiv D'/D\)), \(\partial H/\partial m > 0\), and \(\partial H/\partial \beta > 0\).

**Proof of Propositions 2 and 3**

The structure of possible equilibria is given by the solutions of the equation \(H(p) = 0\). In order to describe these solutions, it is convenient to check the monotonicity of \(H(p)\) and hence to look for the roots of \(H'(p) = 0\). Normalizing \(d = 0\) and \(D'/D = k\), the latter equation is equivalent to

\[
\beta^2 p^2(k - 1) - 2\beta p(\beta k + \alpha k + \alpha) + k\alpha^2 + k\beta^2 + 2\alpha\beta h - \alpha^2 = 0.
\]

where the roots are \(p_{1,2} = \frac{\beta k + \alpha k + \alpha \pm \sqrt{\beta}}{\beta(k-1)}\). The higher root is always larger than 1; the lower root is positive, and can take values either below 1 if returns are relatively low (if \(k < (\frac{1-\alpha}{\alpha})^2\)) or above 1 if returns are relatively high (if \(k > (\frac{1-\alpha}{\alpha})^2\)).

If \(k > (\frac{1-\alpha}{\alpha})^2\), \(H\) is increasing in \(p\) over the interval \([0,1]\). If \(k < (\frac{1-\alpha}{\alpha})^2\), \(H\) is increasing up to \(p_1\) (with \(H(p_1) = D(mk - 1 + \delta \frac{(1-\alpha)k\sqrt{\beta} + k(1-\alpha) - \alpha \sqrt{\beta} + \alpha}{\sqrt{k-1}})\)), and then decreasing.
We also have that $H(1) = d - D + m(D' - d) + \delta \frac{\beta \alpha + \beta d}{\alpha + \beta} - \delta D$ (which simplifies to $H(1) = D(mk - 1 + \delta \frac{\beta k}{\alpha + \beta} - \delta)$ if $d = 0$ and $D'/D = k$), and $H(0) = d - D + m(D' - d) + \delta d - \delta \frac{\beta d + \alpha D}{\alpha + \beta}$ (taking $d = 0$ and $D'/D = k$, $H(0) = D(mk - 1 - \delta \frac{\alpha}{\alpha + \beta})$). It can easily be seen that $H(1) > H(0)$ regardless of parameter values.

We now have the necessary elements to describe the equilibria in our model. If $k > \left(1 + \frac{\beta}{\alpha}\right)^2$, then

- If

$$k \left(\frac{\beta \delta}{\beta + \alpha} + m\right) > 1 + \delta$$

$$mk < 1 + \frac{\alpha \delta}{\alpha + \beta}$$

there is a mixed strategy equilibrium with partial investment, as well as the equilibrium of full investment ($H(1) > 0$, $H(0) < 0$). The mixed strategy equilibrium is however unstable.

- If

$$k \left(\frac{\beta \delta}{\beta + \alpha} + m\right) > 1 + \delta$$

$$mk > 1 + \frac{\alpha \delta}{\alpha + \beta}$$

there is only a pure strategy equilibrium (always invest; $H(1) > 0$, $H(0) > 0$).

If $k < (1 + \frac{\beta}{\alpha})^2$:

- If

$$k \left(\frac{\beta \delta}{\beta + \alpha} + m\right) > 1 + \delta$$

$$mk > 1 + \frac{\alpha \delta}{\alpha + \beta}$$

there is only one pure strategy equilibrium (always invest; $H(1) > 0$, $H(0) > 0$).
one can have both pure strategy equilibria (always invest and never invest), and an unstable mixed strategy equilibrium with partial investment \((H(1) > 0, H(0) < 0)\).

- If

\[
k(\frac{\delta \beta}{\beta + \alpha} + m) < 1 + \delta
\]
\[
 mk < 1 + \frac{\alpha \delta}{\alpha + \beta}
\]

and \(H(p = \frac{\beta k + \alpha k + \alpha - \sqrt{k}}{\beta(k-1)}) > 0\), then there are two mixed strategy equilibria, as well as the pure strategy equilibrium of no investment (which gives the manager a lower expected payoff than either of the mixed equilibria with partial investment; \(H(1) < 0, H(0) < 0\)).

**Proof of Proposition 5**

The possible market prices for high-dividend firms are

\[
P_1^A = D + \frac{1}{2} q \alpha D + \frac{1}{2} \alpha (1-p) d + \frac{1}{2} \delta q \alpha + \frac{1}{2} \beta (1-p) d + \frac{1}{2} \beta (1-p) (1-q) \beta (1-p) + \delta^2 \frac{C}{1-\delta}
\]
\[
P_1^B = D + \frac{1}{2} (1-q) \alpha D + \frac{1}{2} (1-q) \beta (1-p) d + \frac{1}{2} \alpha (1-q) \alpha + \frac{1}{2} (1-q) \beta (1-p) d + \frac{1}{2} (1-q) \beta (1-p) (1-q) \beta (1-p) + \delta^2 \frac{C}{1-\delta}
\]
\[
P_1^C = D + \frac{1}{2} \alpha D + \frac{1}{2} \alpha (1-q) \beta (1-p) d + \frac{1}{2} \beta (1-p) \beta (1-p) + \frac{1}{2} \beta (1-p) (1-q) \beta (1-p) (1-q) \beta (1-p) + \delta^2 \frac{C}{1-\delta}
\]
\[
P_1^D = D + \frac{1}{2} (1-q) \beta (1-p) d + \frac{1}{2} (1-q) \alpha D + \frac{1}{2} (1-q) \beta (1-p) d + \frac{1}{2} (1-q) \beta (1-p) (1-q) \beta (1-p) + \delta^2 \frac{C}{1-\delta}
\]
\[
P_1^E = D + \frac{1}{2} \alpha d + \frac{1}{2} \alpha (1-q) \beta (1-p) d + \frac{1}{2} \beta (1-p) \beta (1-p) + \frac{1}{2} \beta (1-p) (1-q) \beta (1-p) (1-q) \beta (1-p) + \delta^2 \frac{C}{1-\delta}
\]

The informed investor’s trading profits from monitoring high-dividend firms are
\[
\Pi^{high} = \frac{1}{2}\phi(1-x)\delta(P_1^A - P_noinvest)^{1/2}\beta(1-p)q + \frac{1}{2}\phi(1-x)\delta(P^{high_0} - P_1^A)^{1/2}\alpha q \\
= \frac{1}{2}\phi(1-x)\delta\alpha\beta(1-p)q \frac{D - d}{\beta(1-p) + \alpha}
\]

The cost of monitoring high-dividend firms is:

\[
\text{Cost}^{low} = cq(\alpha + \beta(1-p))
\]

As a result, net profits are

\[
\Pi^{low}_{net} = \frac{1}{2}\phi(1-x)\delta\alpha\beta(1-p)q \frac{D - d}{\beta(1-p) + \alpha} - cq(\alpha + \beta(1-p))
\]

Monitoring is worthwhile if net profits are positive; that is, if

\[
\frac{1}{2}\phi(1-x)\delta\alpha\beta q \frac{D - d}{(\beta(1-p) + \alpha)^2} > c
\]

A similar reasoning can be used for low-dividend firms. The possible market prices for low-dividend firms are:

\[
Q_1^A = d + \delta + \frac{1}{2}\beta ps D' + \frac{1}{2}\alpha s d + \delta^2 \frac{C}{1-\delta}
\]

\[
Q_1^B = d + \delta + \frac{1}{2}\beta p(1-s)D' + \frac{1}{2}\alpha (1-s) d + \delta^2 \frac{C}{1-\delta}
\]

\[
Q_1^C = d + \delta D' + \delta^2 \frac{C}{1-\delta}
\]

\[
Q_1^D = d + \delta + \frac{1}{2}\beta p(1-s)D' + \frac{1}{2}\alpha (1-s) d + \delta^2 \frac{C}{1-\delta}
\]

\[
Q_1^E = d + \delta d + \delta^2 \frac{C}{1-\delta}
\]

The trading profits from monitoring low-dividend firms, the cost of monitoring and net profits for the informed investors are:

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\[
\Pi^{low} = \frac{1}{2} \phi(1-x) \delta (P^{invest} - Q^A_1) \frac{1}{2} \beta ps + \frac{1}{2} \phi(1-x) \delta (Q^A_1 - P^{low}) \frac{1}{2} \alpha s \\
= \frac{1}{2} \phi(1-x) \delta \alpha \beta ps \frac{D' - d}{\beta p + \alpha}
\]

\[
Cost^{low} = cs(\alpha + \beta p)
\]

\[
\Pi^{low}_{net} = \frac{1}{2} \phi(1-x) \delta \alpha \beta ps \frac{D' - d}{\beta p + \alpha} - cs(\alpha + \beta p)
\]

Monitoring is feasible if profits are positive, that is, if

\[
\frac{1}{2} \phi(1-x) \delta \alpha \beta p \frac{D' - d}{(\beta p + \alpha)^2} > c.
\]