Signaling, Free Cash Flow and "Nonmonotonic" Dividends

Kathleen Fuller
244 Holman Hall, School of Business, University of Mississippi, University, MS 38677 662-915-5463
Email: kpfuller@olemiss.edu

and

Benjamin M. Blau
326 Holman Hall, School of Business, University of Mississippi, University, MS 38677
Email: bblau@bus.olemiss.edu

Many argue that dividends signal future earnings or dispose of excess cash. Empirical support is inconclusive, potentially because no model combines both rationales. This paper does. Higher quality firms pay dividends to eliminate the free cash-flow problem, while firms that outsiders perceive as lower quality pay dividends to signal future earnings and reduce the free cash-flow problem. In equilibrium, dividends are nonmonotonic with respect to the signal observed by outsiders; the highest quality firms pay smaller dividends than lower perceived quality firms. The model reconciles the existing literature and generates new empirical predictions that are tested and supported.

Keywords: Dividend signaling models; agency conflicts, monotonicity condition; payout policy; cash-flow uncertainty

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1. Introduction

Why does a firm pay dividends? Miller and Modigliani (1961) show that, under certain conditions, dividend policy is irrelevant to firm value. Since then, many arguments have been proposed to rationalize why dividends matter. Maybe firms pay dividends to attract certain clienteles, or maybe to signal information to the market, or maybe just to return excess cash fairly to all shareholders. As of yet, no single theory is dominant. This is perhaps because there are multiple motivations for paying dividends and there is no single reason that applies to all firms. Though there is little evidence of a clientele effect, the empirical contest between the signaling and excess-cash hypotheses continues. (See Allen and Michaely, 2003.)

The inconclusive evidence makes it hard to pick a theoretical winner as to why firms pay dividends. Perhaps one reason for the mixed evidence is that the literature lacks an integrated theory that incorporates both the signaling and excess-cash motives. In this paper, we develop a simple argument that ties the two together and helps explain the inconclusive evidence. Based on this argument, we generate and test new predictions to help explain why firms pay dividends.

The dividend-signaling hypothesis suggests that managers with better information than the market signal using dividends. Bhattacharya (1979), John and Williams (1985) and Miller and Rock (1985) develop dissipative signaling models in which either taxes or financial distress costs make dividends a credible signal. The excess-cash hypothesis suggests that since managers cannot credibly precommit not to invest excess cash in negative-NPV projects, dividend changes can convey information about how the firm will *use* future cash flows. Easterbrook (1984), Jensen (1986) and Lang and Litzenberger (1989) suggest that increasing dividends ensures less potential waste of free cash flow. The empirical implication from both hypotheses is that increasing (decreasing) dividends should evoke a positive (negative) stock-price reaction. The empirical literature reports such reactions.

While at a general level both explanations for dividends appear to have empirical merit, bothersome gaps exist between the theories and the data. Consider the signaling hypothesis first.

Its strongest prediction is that there is a monotonic relation between unexpected dividend changes and new information about future earnings acquired by the manager. This means that future earnings should be strictly increasing in (unexpected) dividend increases. This prediction is typically generated in a static model in which there are firms that are a priori observationally identical to outsiders but have different levels of future earnings about which firm managers are privately informed. Thus, one should test for a cross-sectional relation. This is difficult because the empiricist must determine the set of firms that look the same to the market just before the announcement. Perhaps this is why the empirical evidence for the signaling hypothesis seems inconclusive.

As Allen and Michaely (2003) point out, the evidence supportive of the signaling hypothesis indicates that dividend changes are associated with stock-price changes of the same sign around the dividend-change announcement and that the immediate price reaction is related to the size of the dividend. Bernheim and Wantz (1995) argue that if dividend income is taxed more heavily, then the effect of the dividend signal on stock prices should be greater. They find evidence consistent with their argument. However, using data from 1978-1996, Bernhardt and Lee (2001) do not find that dividend taxes and signals are positively related. Benartzi, Michaely and Thaler (1997) show that the relation between dividend changes and subsequent earnings changes is inconsistent with the theory; it appears that dividends are related more strongly to past earnings than future earnings. Further, there is a significant price drift in subsequent years and, perhaps suggestive of the free cash-flow hypothesis, it is the large and profitable firms, with less informational asymmetries, that pay most of the dividends.

Bernhardt, Douglas and Robertson (2005) exploit the monotonicity property that the signaling theory predicts. Using nonparametric techniques, they find that the information content in dividends is not positively related to the marginal cost of dividends. They also find that excess returns, rather than excess returns per dollar of dividend (as Bernheim and Wantz,1995, predict) are more strongly related to the tax regime. Bernhardt, Douglas and Robertson argue that signaling theories do not fully explain dividends. Deshmukh (2003) applies a hazard model and finds that the probability of dividend initiation is negatively related to growth opportunities, thus contradicting the signaling theory.

Allen and Michaely (2003) discuss similarly mixed evidence about the free cash-flow hypothesis. For example, Grullon, Michaely and Swaminathan (2002) find that firms anticipating declining investment opportunities are likely to increase dividends, and Lie (2000) finds that firms increasing dividends have more cash than industry peers. Borokhovich, Brunarski, Harman and Kehr (2005) find firms with more outside directors experience positive returns at announcement of sizable dividend increases. Rozeff (1982) finds that dividends reduce agency costs but increase the transaction costs of issuing equity. These papers support the free cash-flow hypothesis. However, Yoon and Starks (1995) report a symmetric price reaction to dividend changes across high Tobin's Q and low Tobin's Q firms, which goes against the free cash-flow hypothesis.

In the argument we develop, the dividend can signal the manager's private information about future cash flow when the market is unaware of it or disgorge excess cash to minimize the free cash-flow problem, even when the manager and the market are symmetrically informed about future cash flow. As is standard in discrete signaling models, we stipulate two types of observationally-identical firms, good and bad, each with different future cash flows. Based on observed performance, the market identifies each firm's type before learning the future cash flow. Similar to prior research, we define performance as a function of past earnings (e.g., Lakonishok, Shleifer and Vishny 1994). Beaver (1968) suggests that if earnings contain information, then when earnings are reported, a change in investors' assessments of the probability distribution of future performance occurs. Using earnings as a measure of past performance allows investors to reassess the quality of the firm when they observe the latest earnings. The model has three observationally-distinct groups of firms. Good firms can be correctly identified when their prior performance is good. Good and bad firms can be lumped together in the same group when their prior performance is ambiguous. Bad firms can be correctly identified when their prior performance is poor.

The core intuition behind our analysis joins two simple ideas. One is that informational asymmetry about a firm's future prospects is likely to be the greatest when its observed performance is neither good nor bad, but investors realize that such firms make up a mixed bag. The other is that the free cash-flow problem is the most severe when the firm's performance is good and its past cash flow is relatively high. Pasting these two ideas together makes the possibility of nonmonotonic dividend equilibria arise rather naturally. The identifiably bad firms pay low dividends because there is no informational asymmetry about them and they have relatively low free cash. The identifiably good firms pay dividends, but to reduce the severity of the free cash-flow problem rather than to signal. Finally, the good firms with the ambiguous past performance pay the highest dividends because they need to distinguish themselves from the observationally identical bad firms and they also need to deal with the free cash-flow problem. Even if no firm-type information asymmetry exists, firms may need to address the free cash-flow problem. While CEOs may maximize shareholder wealth, junior managers may not. If a manager's status in the firm depends on the assets under their control or expropriates wealth from another division, the manager may take negative-NPV projects. Due to information asymmetries within the firm (not between the firm and the market), the CEO cannot eliminate this incentive. However, by precommitting to a dividend, the CEO reduces the free cash flow available for junior managers to waste.

The equilibrium thus entails a nonmonotonicity in dividend payments with respect to the signal observed by the market at the interim date; the highest quality firms pay lower dividends than those of intermediate quality. In a standard signaling equilibrium, higher quality types distinguish themselves from lower quality types by emitting a signal of greater magnitude. This occurs because the signal being modeled is the only instrument by which the higher quality types can separate themselves. By contrast, in our model, the good quality types can avail of other (possibly costless) information – such as past performance – to separate themselves, so type-dependent signaling is restricted to a subset of types.

The nonmonotonicity of the equilibrium is important for the following reason. If one views monotonicity as an essential ingredient of a signaling equilibrium, as is the case with a standard signaling model, then one risks empirically rejecting the signaling explanation for dividends merely because the data are inconsistent with monotonicity. Our approach generates other testable predictions. We hypothesize that firms that have low prior performance pay the lowest dividends and have little heterogeneity in their future earnings, while firms that have high prior performance pay high dividends to avoid the free cash-flow problem but also have little heterogeneity in their future earnings. Firms with intermediate prior performance pay the highest dividends, have the highest intragroup heterogeneity in current dividend payments as well as future earnings and have the greatest variability in price reactions to dividend changes.

We test these predictions using a sample of firms with regular quarterly dividend payments between 1980 and 2000. We find that firms with intermediate past performance pay significantly larger dividends and have higher unexpected future earnings compared to those with low or high past performance. Also, firms with intermediate past performance have greater variability in dividends and future earnings among themselves, reflecting greater intragroup heterogeneity, compared to firms with low or high past performance. Finally, we find significantly higher variability in the price reaction associated with dividend increases for firms with intermediate performance than for firms with high or low past performance. The findings bridge the gap between the theoretical and empirical literature. We find evidence that the nonmonotonicity in dividends can be explained by a combination of the signaling hypothesis and the free cash-flow hypothesis.

2. The theoretical argument

In this section, we lay out the theoretical argument that motivates our empirical analysis. The full model is in the Appendix . Suppose we have two types of firms; the types are privately known to their mangers and a priori unknown to the market. We think of the types as earnings distributions and assume that earnings determine the cash flow and free cash flow of a firm. For convenience, we call the types good (G) and bad (B). The G earnings distribution stochastically dominates the B distribution, with the two having overlapping supports. The realization of earnings is publicly observed. Some firms experience such high earnings that the market unambiguously identifies them as G firms. Similarly, some firms experience earnings so low that they are unambiguously recognized as B firms. There also are firms with intermediate earnings, the managers of which face two problems. One is asymmetric information about the type and thus the value of the firm. That is, managers of G firms with intermediate earnings know the type and value of the firm, while the market is unsure. The managers want to separate their firms from other intermediate earnings firms in order to raise their stock prices.

The other problem faced by managers of intermediate earnings firms is free cash flow. When firms have more cash than they need, there can be value dissipation because of inefficient investments, empire building, etc. While a CEO may a strong preference for maximizing shareholder value, junior managers may not. CEO compensation is more sensitive to the firm’s stock price, plus the CEO faces direct pressure from institutional shareholders to attend to shareholder value. Thus, when free cash flow exists, the CEO and junior managers want to invest it in positive NPV projects. However, if no positive NPV project is available, junior managers may still prefer to invest. The junior manager’s relative status in the firm can depend on the resources under his control. Alternatively, as Scharfstein and Stein (2000) suggest, junior managers potentially could influence CEOs and be compensated through non-monetary means, including receiving resources to invest in projects that enhance the junior manager’s division but decrease overall firm value.

The CEO can reduce the free cash flow available for junior managers to waste by paying dividends.

Asymmetric information can also exist between managers (who know the firms' true value including future investment opportunities) and the market (which does not). Based on past performance, investors identify firms as having high earnings (G), low earnings (B) or intermediate earnings (either G or B). When a G firm reports consistently high earnings, investors unambiguously distinguish the G firm. The information asymmetry in the G firm's future investment opportunities declines as the consistency of high reported earnings increases. Firms that are unambiguously identified as G firms, because of their high, consistent earnings realizations, face less of an asymmetric information problem than intermediate firms. However, G firms likely face a larger free cash-flow problem. Thus, they pay a dividend to reduce excess cash. Similar to the argument above, the firms unambiguously identified as B due to low earnings also face no asymmetric information problem between the managers and the market. As investors observe consistently poor earnings for B firms, the asymmetric information between the CEO and the market decreases because consistent poor performance reveals the true value. They may not face a free cash-flow problem, but if they do, it will be smaller than that faced by the high earnings firms. This leads to two testable hypotheses. First, the high earnings firms pay a higher dividend than the low earnings firms. Second, there is relatively low intragroup heterogeneity within the high earnings firms, and also within the low earnings firms, of their future cash flow.

Now consider the firms with intermediate earnings, which investors cannot distinguish as G or B from earnings alone. The true G firms in the group use dividends to signal in order to separate themselves from the observationally identical B firms, and also to deal with the free cash-flow problem. If the signaling incentive-compatibility constraint is the binding constraint, as opposed to the size of the dividend needed to resolve the free cash-flow problem, then G firms in the intermediate earnings group pay higher dividends than G firms in the high earnings group. That is, the dividend needed to signal is higher than that needed to resolve the free cash-flow problem. Moreover, the B firms with intermediate cash flows do not signal and may or may not pay dividends to resolve a free cash-flow problem.

This leads to the further testable hypothesis: there is greater intragroup heterogeneity within the intermediate earnings group than the other two groups. Also, the firms that pay high dividends in the intermediate earnings group (the G firms) may pay higher dividends than the high earnings firms. The firms that pay low dividends in the intermediate earnings group (the B firms) pay roughly the same dividends as B firms in the low earnings group. If there is a relatively high proportion of G firms in the intermediate earnings group, then they also are expected to pay higher average dividends than firms unambiguously identified as G. Thus, the relation between dividends and firm type could be nonmonotonic, as shown in Figure 1. The observably lowest quality firms pay the lowest dividends, the observably highest quality firms pay higher dividends and the intermediate firms pay the highest dividends.

Firms could migrate between groups over time, but it seems likely that if an unambiguously identified G firm started to experience lower earnings and became identified by investors as an intermediate firm, the CEO would change the firm's strategy and increase the dividend to separate the firm from B firms in the intermediate group.

Whether the relation between dividends and firm type is nonmonotonic depends on whether the incentive compatibility constraint for signaling is binding or the free cash-flow constraint on dividends is binding for the firms in the intermediate earnings group. If the signaling constraint is binding, then the G firms in this group pay higher dividends than the G firms that are unambiguously identified because of high cash flows. This can lead to nonmonotonicity. But if the free cash-flow constraint on dividends is the binding constraint, the G firms in the intermediate-earnings group pay the same dividend as the G firms in the high-earnings group. Consequently, the average dividends in the intermediate earnings group are lower than those in the high earnings group, but higher than those in the low earnings group. The relation between dividends and firm quality in this scenario is monotonic.

Thus, whether the relation between dividends and firm quality is monotonic or nonmonotonic depends on the data. If free cash-flow considerations alone determine dividends, then dividends are monotonically increasing in firm quality. If signaling considerations alone determine dividends, then dividends are nonmonotonic in firm quality. When both free cash flow and signaling are combined, we obtain either a monotonic or nonmonotonic relation between dividends and firm quality, depending on which effect dominates for the intermediate earnings firms.

By joining three ideas — signaling, free cash flow and observably distinct firm types — it is possible to obtain an equilibrium in which the relation between dividends and observable firm quality can be nonmonotonic, leading to novel hypotheses about the heterogeneity of firms within an observationally identical group.

3. Empirical predictions and tests

The theoretical argument has several new empirical predications not generated by the standard signaling models or free cash-flow models. In what follows, we refer to the prior performance of firms as high, intermediate, or low. These labels should not be interpreted literally. The firms classified as "low" are not necessarily firms with low prior performance in an absolute sense. Rather, among firms that paid dividends, these firms had the lowest relative performance.

3.1 The predictions

Hypothesis A: Firms that have intermediate prior previous performance pay the highest dividends and have more heterogeneity in future earnings among themselves than firms with low performance.

One aspect that makes this hypothesis different from the prediction of the standard signaling model is that it refers to firms that are observationally distinct from other firms. The other difference is that this is a hypothesis about intragroup earnings heterogeneity among low performance firms and among intermediate performance firms. This is an issue not addressed in the standard signaling model.

Hypothesis B: Firms that have high prior performance pay dividends to protect against losses due to the free cash-flow problem but also have less heterogeneity in future earnings among themselves than firms with intermediate prior performance.

We argue above that firms with high performance have an incentive to pay dividends to mitigate the free cash-flow problem. All of these firms are G, so they also have less intragroup heterogeneity in their future earnings, compared to the heterogeneity among firms with intermediate earnings. The novelty of this hypothesis is the linking of the prior performance of firms in an observationally identical group to heterogeneity in future performance among the group members. We know of no other study that does this.[1]

Hypothesis C: Firms with intermediate performance will have the highest intragroup heterogeneity in current dividend payments and future earnings compared to any other group.

This prediction is a direct consequence of the fact that the intermediate earnings group contains both B and G firms. The range of dividend payments across intermediate earnings firms is larger than for firms with low or high prior earnings. This happens because dividends both signal and help resolve free cash-flow problems in the intermediate group but only address the free cash-flow problem in the low and high earnings groups. Further, past and future earnings should have the greatest heterogeneity among intermediate firms because both G and B firms are in the group. This is perhaps the most novel prediction of our argument.

Hypothesis D: The cumulative abnormal returns (CARs) associated with the announcement effects of dividends display greater intragroup heterogeneity for intermediate performance firms than for either high performance or low performance firms.

Firms with intermediate-prior performance include the G firms that choose high dividends and the B firms that choose lower dividends. Given that the market views firms in this group as observationally identical, the dividend-announcement effect should be positive in re-

[1] Sant and Cowan (1994) report that dividend omissions are associated with increases in the variance of omitting firm's future earnings, suggesting that managers omit dividends because future earnings become less predictable.

sponse to the G firms' high dividend and negative in response the B firms' low dividends, creating high intragroup variance in the CARs. By contrast, the other two groups are more homogenous in dividends and hence CARs.

Hypothesis E: Dividends are not necessarily monotonic in observed firm quality.

Existing signaling models predict that the larger the dividend change, the larger the price reaction; the empirical literature supports the prediction.[2] What is different about our hypothesis is the statement that the dividend increase is not monotonic in observed firm quality. If the fraction of G firms in the intermediate group is sufficiently high, and the signaling-driven dividend sufficiently larger than needed to only resolve the free cash-flow problem in G firms, then it is possible for a nonmonotonic relation to exist between dividends and firm quality, as in Figure 1.

It is important to point out the dynamics of the above hypotheses. We do not limit G firms in the intermediate earnings group to remain classified as intermediate. It is possible for a firm to experience consistently high cash flows over several periods, leading to being unambiguously identified as G. However, we assume that firms change their dividend strategies accordingly. The migration among groups over time is outside the scope of our theoretical argument. For robustness, however, we provide tests that attempt to capture the possibility of firms being reclassified by investors throughout the sample period.

2.2 Data

We identify a sample of 2,197 NYSE, AMEX and Nasdaq listed dividend-paying firms from 1980 through 2000 from the Center for Research in Security Prices (CRSP) U.S. common stock database. Sample firms meet the following criteria:

i) The dividend must be a regular quarterly U.S. cash dividend (CRSP distribution code 1232).

[2] See Allen and Michaely (2003). This is a natural extension of the two-firm-type case to the multi-firm-type case in which all types are separating from each other.

ii) Daily return data for the 60 trading days surrounding the dividend announcement are available from CRSP.

iii) The firm is listed in the Compustat quarterly database.

For the empirical tests, we classify firms based on prior earnings and examine dividend payments and future earnings changes for the resulting groups. We use earnings as a measure of performance, as Beaver (1968) argues that investors assess the quality of firms each time earnings are reported. The assessment of firm quality is critical to our argument that observed performance leads to the firm type.[3] To reduce the chance that our results are not simply capturing mean reversion in accounting data as reported in Barber and Lyon (1996), we match each firm in our sample with a control firm. We measure prior performance as the firm's earnings relative to the median earnings in the same industry, defined as the two-digit Standard Industrial Classification (SIC) code, for the six months before the dividend payment.[4] Since we are using all dividend-paying firms listed on CRSP and Compustat, if we used one firm as a control, it is highly likely that the control firm would also be in our sample. We could use a non-dividend paying firm as the control firm, however, Fama and French (2001) find many distinct differences between dividend and non-dividend paying firms. It would be hard to determine whether the results were driven by such differences.

For each firm, we compute abnormal earnings six months before the dividend payment. We define abnormal earnings as the difference between the earnings six months earlier and the corresponding median earnings for the firm's industry. We measure variability in abnormal earnings as the variance of abnormal six-month performance over a three-year period.[5] Since a firm with highly variable earnings is harder to define as having low quality, we believe that the best way to

[3] We also measure prior performance based on financial returns for six months prior to the dividend payment and on operating income for six months prior to the dividend payment and measure abnormal performance as the difference between earnings and expected earnings using the Barber and Lyon (1997) method of matching firms. All results are qualitatively similar and available from the authors.
[4] We also measure prior performance using earnings of one and two years before the dividend.
[5] We also calculate the variability over two years, four years, and five years and find qualitatively similar results.

classify firms into low, intermediate and high prior performance groups is to not only examine the firm's prior earnings but also the variance in those earnings. Thus, to be classified as a firm with low prior performance, the firm must have both low prior abnormal earnings for the year (in the bottom quartile for that year) and low variance of abnormal earnings. Similarly, to be classified as having high prior performance, the firm must have earnings in the highest quartile for that year and have low variance of abnormal earnings. Firms with either earnings between the low and high cutoff values or with high variance in past abnormal earnings are classified as having intermediate prior performance.[6]

Table 1 reports descriptive statistics. Based on prior performance the firms are separated into three groups. The average firm in the high prior performance group has market (book) value of $3.1 billion ($2.75 billion) and a dividend of $0.227. The average firm in the intermediate prior performance group has a market (book) value of $3.4 billion ($3.58 billion) and a dividend of $0.256. The average firm in the low performance group has a market (book) value of $2.84 billion ($2.93 billion) and a dividend of $0.202. Firms in the intermediate performance group, on average, pay the highest dividends and have larger changes in earnings.

3. Empirical results

3.1 Univariate tests

Hypothesis A predicts that firms with low prior performance pay the lowest dividends and have less intragroup heterogeneity in future earnings than do firms with intermediate prior performance. Table 2, Panel A shows that the low performance group has an average dividend pay-

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[6] Robustness checks using the cutoffs other than 25%, produce few variations in results. As our data are stratified with the most volatile earnings firms being in the intermediate prior performance group and the most stable prior earnings firms in the low and high prior performance groups, our results might seem mechanical. However, there is no guarantee that future performance will follow past performance or that future performance will be volatile or stable. We further address this concern by examining whether intermediate prior performance firms have greater changes in their variance of earnings than firms with low or high prior performance. We calculate the change in variance as the difference between the variance of past earnings and the variance of future earnings. The model predicts that intermediate firms would have larger changes in variance of their earnings because observationally distinct good and bad firms should not have large changes in the variance of their earnings. We find that intermediate firms have greater variance in their future earnings even after controlling for the past earnings variance. These results are available from the authors.

ment of \$0.169 and an average dividend yield of 3.264%, the intermediate performance group has an average dividend payment of \$0.213 and an average dividend yield of 2.963%, and the high performance group has an average dividend payment of \$0.172 and an average dividend yield of 2.247%. The difference-of-means tests for the dividends are significant at five percent or better. Thus, firms with intermediate prior performance pay the highest dividends of all groups. While the low prior performance group has a higher dividend yield on average due to a lower average price, the difference is not statistically or economically significant.

To investigate whether the intragroup variation in future earnings is larger for the intermediate performance firms than for the low performance firms, we use two measures of unexpected future earnings. The first is Benartzi, Michaely and Thaler's (1997) estimate of future earnings based on a random walk with a drift; earnings this quarter should equal earnings last quarter plus the average growth rate from quarters –5 to –1. Therefore, unexpected future earnings are

$$UE_{i,t} = \frac{(E_{i,t} - E_{i,t-1}) - (E_{i,t-1} - E_{i,t-5})/4}{MV_{i,t-1}}, \tag{1}$$

where $UE_{i,t}$ is the unexpected earnings of firm i in quarter t, $E_{i,t}$ is its earnings in quarter t and $MV_{i,t-1}$ is its market value one quarter prior to the dividend payment. Barber and Lyon (1997) show that it is important to measure accounting variables relative to an appropriate benchmark, e.g., industry-adjusted earnings. Our second measure of future earnings incorporates an industry adjustment. We compare the earnings of firms that change their dividends to the average unexpected earnings of firms in the same two-digit SIC industry. That is, unexpected future earnings are

$$UE_{i,t} = \frac{(E_{i,t} - E_{i,t-1})}{MV_{i,t-1}} - \frac{1}{J}\sum_{j=1}^{J}\frac{\left(E_{j,t} - E_{j,t-1}\right)}{MV_{j,t-1}}, \tag{2}$$

where $E_{j,t}$ is the earnings of firm j that is in the same two-digit SIC code industry as firm i in quarter t and all other variables are as previously defined.

Table 3, Panel A reports that the intermediate performance firms have significantly higher unexpected earnings, for the four quarters after the dividend change, than firms in the low performance or high performance groups; Table 4, Panel A reports similar results using industry-adjusted future earnings. Table 3, Panel B shows that there is greater variability in future earnings in the intermediate performance group than in the low performance group; the industry-adjusted results in Table 4, Panel B again are similar. Thus, firms with low prior performance have significantly less heterogeneity in their future earnings than do intermediate-prior-performance firms.

Hypothesis B predicts that firms with high prior performance have less heterogeneity in future earnings than firms with intermediate prior performance. Table 3, Panel B and Table 4, Panel B report that high prior performance firms have less variability in future earnings than intermediate prior performance firms for four quarters after the dividend increase. Further, Table 3, Panel A and Table 4, Panel A show that the intermediate performance firms have significantly larger future earnings than the high performance firms, but only for two quarters after the dividend increase.

Hypothesis C predicts that firms with intermediate prior performance have the largest intragroup heterogeneity in current dividend payments and in past and future earnings when compared to firms with high or low prior performance. Table 2, Panel B indicates that firms with intermediate prior performance have the largest intragroup variation in current dividend payments compared to the other groups. However, all groups have similar intragroup variations in dividend increases. Table 3, Panel A and Table 4, Panel A also show that intermediate prior performance firms have significantly higher intragroup variability in future earnings, for both measures of unexpected future earnings, than firms with either low or high prior performance.

In summary, the results in Tables 2 through 4 support hypotheses A, B and C. Firms in the intermediate group pay significantly larger dividends than the high or low group. Intermediate group firms have the largest intragroup variation in future earnings as well as in dividend payments. The findings are consistent with our theoretical argument that intermediate earnings firms pay higher dividends than high earnings firms both to control the free cash-flow problem and to signal to investors by distinguishing themselves from B firms in the intermediate group. Further, the intragroup variability of future earnings and dividend payments is also consistent with our model.

We test whether CARs have greater intragroup heterogeneity for the intermediate performance firms than for either the high performance or low performance firms, as predicted by Hypothesis D. We use market-adjusted returns to estimate abnormal returns. We calculate daily abnormal returns as

$$AR_{it} = R_{it} - R_{Mt} \tag{3}$$

where R_{it} is firm i's daily stock return on date t and R_{Mt} is the return for the value-weighted CRSP index on date t. We calculate abnormal returns for a three-trading-day event window centered on the announcement date. The cumulative abnormal return (CAR) is the sum of the three abnormal returns.

We also consider another aspect of signaling, the effects of dividend increases and decreases. While it is outside the scope of this article to measure the strength of the signal produced by exceeding expectations, a dividend increase (or decrease) is likely to result in greater variability for intermediate firms. Our reasoning is that G firms in the intermediate group obtain a greater response from a dividend increase than B firms in the intermediate group. This intragroup variation is likely greater than the variation in the unambiguous groups. Table 5, Panel A reports that firms with high prior performance have significantly higher CARs than firms with low or intermediate prior performance when there are dividend increases and significantly greater variability in CARs. Panel B reports that firms with low prior performance have the most negative returns while firms with intermediate prior performance have the least negative returns. The intragroup variability in the CARs for firms with intermediate prior performance is also significantly greater than that of firms with low or high prior performance for dividend decreases.

Finally, Hypothesis E predicts that dividends are monotonic in observed firm quality. From Table 2 we know that firms with intermediate prior performance pay the largest dividends. Also, as the intermediate performance group contains both G and B firms, and there is greater heterogeneity in this group, there should be B firms that pay lower dividends than the G firms that pay higher dividends for signaling and free cash-flow reasons. In table 6, we split the firms in each performance group based on the median yearly dividend per share and yield for the group. We expect the dividends of above median firms in the intermediate group to be similar to the those of the low prior performance group and greater than those of the high prior performance group. Table 6 reports no significant difference between the dividends paid by low prior performance firms and below median firms in the intermediate group. However, above median firms in the intermediate performance group have significantly larger dividends than the high performance group. There is no significant difference between the above median and below median dividends within the low or high prior performance group. These findings support nonmonotonicity.

We recognize that our model does not incorporate classification shifts over time. While it is likely that managers of firms plan for multiple future periods, our model, similar to other signaling models, maximizes the utility of the manager in a single period (e.g. Miller and Rock, 1985). A dynamic utility maximization problem may be more fitting to examine the behavior of managers. However, we keep our theoretical model simple to explore the possibility that dividends are nonmonotonic cross-sectionally because of the motivations of managers of intermediate earnings firms at a specific point in time.

Accordingly, we test the nonmonotonic relation between firm type and dividends in subperiods. Table 7 reports the cross-sectional mean of dividends and the difference between the groups for subperiods. To be consistent with our conjecture, the distribution of the dividend amount by firm type ought to look similar to Figure 1. In every period except 1990-1991, the intermediate prior performance firms pay the largest dividend. The intermediate prior performance firms always pay a significantly higher dividend than the low performance group and a significantly higher dividend than the high performance group for most years. Also evident from this table is a significant decrease in average dividend payments from 1980 to 2000.

3.2 Regressions

We further test the prediction of nonmonotonicity using regression to control for factors outside the theoretical model. We create three dummy variables that classify the firms based on their prior performance being low, intermediate or high. We represent growth opportunities using the market-to-book ratio calculated the month before the dividend announcement and the dividend yield variable is that of the prior year. We estimate the following regression,

$$\Delta = \beta_1 \text{Low} + \beta_2 \text{Intermediate} + \beta_3 \text{High} + \beta_4 \text{Lsize} + \beta_5 \text{Mktbk} + \beta_6 \text{DivYld} + \text{error} \quad (4)$$

where Δ is either the quarterly dividend per share or the dividend standardized by the firm's price one week prior to the announcement, Low is 1 if the firm has low prior performance, Intermediate is 1 if the firm has intermediate prior performance, High is 1 if the firm has high prior performance, Lsize is the log of the market capitalization of the firm one month prior to the dividend announcement, Mktbk is the firm's market-to-book ratio one month prior to the dividend announcement and DivYld is the firm's dividend yield for the year prior to the dividend announcement. We also include but do not report year fixed effects.[7]

Table 8 reports the results. For both definitions of the dividend dependent variable, the coefficients on Low, Intermediate and High follow the nonmonotonic relation predicted by the theoretical argument. Further, the coefficients for Low, Intermediate and High are significantly different from each other at the one-percent level (F-value=46.42 for the dividend and F-value=19.69 for the dividend increase). We also test differences between the coefficients for Low and Intermediate, Intermediate and High, and Low and High; all three pairs are significantly different than each other for both regressions at the one percent level. Firm size has a significant and positive effect on the dividend paid and the dividend increase, whereas growth opportunities have

[7] A White (1980) test does not indicate the presence of heteroskedasticity in the errors of the regressions.

a negative and significant effect on the dividend paid and the dividend increase. These results can be explained in the context of Fama and French (2001). Fama and French find that large firms and firms with few growth opportunities generally pay more in dividends. Thus, we would expect a positive relation between firm size and both the dividend and the dividend increase and a negative relation between the firm's growth opportunities and both the dividend and the dividend increase. The firm's dividend yield does not have a significant effect on the dividend or the dividend increase.

As Grullon and Michaely (2002) report, the repurchase activity of firms during our sample period increases dramatically. While the model does not explicitly account for repurchases, the theoretical argument should apply to the total payout of a firm. To ensure that our results hold when accounting for the firm's total payout, we run the regression:

$$\text{TotalPay} = \beta_1 \text{Low} + \beta_2 \text{Intermediate} + \beta_3 \text{High} + \beta_4 \text{Lsize} + \beta_5 \text{Mktbk} + \beta_6 \text{TotalPay}_{-1} + \text{error} \quad (5)$$

where TotalPay is the total payout of the firm in year t, TotalPay_{-1} is the firm's total payout for year t-1 and all other variables are as previously defined. Following Grinstein and Michaely (2005), total payout is the total repurchase per share for the year plus four times the last quarterly dividend of the year. We include the firm's lagged total payout because Michaely and Grinstein suggest it has a positive effect on current total payout. Unreported year fixed effects are also used.

Table 9 shows that indeed the firm's total payout follows a nonmonotonic relation for low, intermediate and high prior performance groups, with intermediate firms having the highest total payout. The coefficients of Low, Intermediate and High are significantly different from each other at the 1% level (F-value=10.02) and the coefficients for Low and Intermediate, Intermediate and High, and Low and High are significantly different from each other at the 5% level. Firm size and past total payout are both positively related to firm's current total payout.

Finally, we test the prediction that firms with intermediate prior performance have larger announcement-day CARs than firms with high and low prior performance. We estimate the following regression.

$$\text{CAR} = \beta_1 \text{Low} + \beta_2 \text{Intermediate} + \beta_3 \text{High} + \beta_4 \text{Lsize} + \beta_5 \text{Mktbk} + \beta_6 \text{DivYld} + \text{error} \quad (6)$$

Table 10 reports that firms with low prior performance have the highest CARs while firms with high prior performance have the lowest CARs. Those with intermediate prior performance have CARs similar to the low prior performance group. However, an F-test fails to reject equality of the coefficients for Low, Intermediate and High, nor is any paired difference among them significant. Further, neither firm size nor divided yield is a significant determinant of CAR. The market-to-book ratio has a positive and significant relation with CAR. Thus, the larger the growth opportunity, the larger the price reaction to a dividend increase.

4. Conclusion

We develop an argument in which firms pay dividends to signal future earnings or to disburse excess cash flows or both. Firms can be classified into three observationally distinct groups using their prior performance, so that signaling occurs only within each group and not across groups. If one lumps these firms together in examining their dividend payments and the stock price reactions to them, one can encounter nonmonotonicities. Our argument captures the notions of heterogeneity across a priori observationally distinct groups and heterogeneity within a group of observationally identical firms. We hypothesize that firms with the lowest prior performance pay the lowest dividends because they are correctly identified by their prior performance and thus have nothing to signal and also face a relatively small free cash-flow problem. The firms with the best prior performance are correctly identified as such, so they have no signaling concerns and pay somewhat higher dividends to cope with their larger free cash-flow problem. However, firms with intermediate prior performance pay dividends to solve their free cash-flow problem and as a signal to distinguish themselves from others with similar prior performance. Thus, the intermediate firms, which should have the highest intragroup heterogeneity in past and future earnings as well as dividends and price announcement effects, may pay larger dividends than firms with the highest and lowest prior performance. This integration of the signaling and free cash-flow hypotheses provides a new way to examine the data.

The empirical tests support our predictions. In particular, there is a nonmonotonic relationship between firm quality and dividends. We also find that firms that have low or high prior performance display little heterogeneity in future earnings, while firms with intermediate prior performance have high future and past earnings heterogeneity and have the highest heterogeneity in current dividend payments. Finally, firms with intermediate prior performance have the highest abnormal stock-price reaction to a dividend change.

Our empirical finding that dividends are nonmonotonic in observed firm quality is important because it validates our motivating intuition that the weakness of the empirical support for the dividend-signaling hypothesis could be due to this nonmonotonicity. The potential confounding between what the market knows and what it does not know at the time of signaling is likely to apply to many signaling situations, not just dividends. This could be a fruitful area for future research.

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Appendix

A.1 Model

Suppose there are innately two types of firms: ϑ=G (good quality) and ϑ=B (bad quality). Let p be the prior probability that firm is G and (1-p) be the prior probability that firm is B. A good-quality firm has two possible future cash flows (CFs): H or L where H > L > 0. A bad-quality firm has two possible future CFs: L or 0. Let *x* represent the CFs, then Pr (x = H $|$ G) = q, Pr (x = L $|$ G) = 1 – q, Pr (x = L $|$ B) = q, and Pr (x = 0 $|$ B) = 1 – q. Future CFs are realized at time t=2 and observed by all. At time t=1, there is a signal, *s*, that outsiders observe that conveys additional information about the cash flows at t=2. Think of *s* as an informative signal produced by the union of the firm's past performance (prior to t=1) and additional interim performance information – such as an interim earnings report – that may become available at t=1. The signal can take one of three values, 0, L, or H. If the firm is G, then $s \in$ {L, H} and if the firm is B, then $s \in$ {0, L}. The probability distribution of *s* is given by: Pr(s=H $|$ G) = q, Pr(s=L $|$ G) = 1-q, Pr(s=0 $|$ G) = 0, Pr(s=H $|$ B) = 0, Pr(s=L $|$ B) = q, and Pr(s=0 $|$ B) = 1-q. Note there is no correlation (by assumption) between the *s* observed at t = 1 and the CF(x) at t = 2, conditional on the firm's type; unconditionally, *s* and *x* are correlated through firm type. Also at t=1, the manager observes his firm's true type. After the market receives its signal *s*, the manager announces at t=1 the dividend the firm will pay at t=2. We assume, for simplicity, that the previous dividend level was zero, so any dividend d > 0 at t=1 represents a dividend increase. Therefore, at t = 1 there are three observationally distinct types of firms:

1. Firms for which *s* = H is observed by outsiders. These firms are identified correctly as G with probability 1.
2. Firms for which *s* = L is observed. These firms could be either G or B.
3. Firms for which *s* = 0 is observed. These firms are identified correctly as B with probability.

   For firms in Group 2, the probability the firm is identified as G, given *s* = L or B, is:

$$\Pr(G|s=L)=\frac{\Pr(s=L\,|\,G)\Pr(G)}{\Pr(s=L)}=\frac{[1-q]\times p}{[1-q]\times p+q\times(1-p)}\;=\phi_G$$

and $$\Pr(B|s=L)=\frac{\Pr(s=L\,|\,B)\Pr(B)}{\Pr(s=L)}=\frac{[1-q]\times[1-p]}{[1-q]\times p+q\times(1-p)}=\phi_B\;.$$

We assume that each manager maximizes a utility function, defined as:

$$E[U]=aP_1+bP_2-\sum_{x<d}\Omega[d-x]\Pr(x|x<d,\tau)\,, \tag{1a}$$

where P_1 is the firm's price at t=1, P_2 is the firm's expected ex-dividend price at t=2 plus the value of the dividend payment to the shareholders, and Σ[d-*x*] is the non-pecuniary penalty suffered by the manager when the realized cash flow, *x*, falls short of the dividend d; here Σ>0 is a constant. We assume that a,b > 0, and the risk-free rate is 0. Everyone is assumed to be risk neutral. Firms may face a free cash flow (FCF) problem at t = 1. We assume this problem only exists for cash flows exceeding L, i.e. for *x* – L. Suppose that for any dividend commitment d, the loss in value due to the FCF problem, P, is increasing and convex in the amount of free cash employees can waste. That is, P = *f*(H-L-d), where H-L-D is the free cash flow available and $f' > 0$, $f'' > 0$. If we take the total derivative of P with respect to d, we obtain

$$\partial P/\partial d \quad = f'\,(-1) < 0$$

and $$\partial^2 P/\partial d^2 \;= f'' > 0.$$

The idea is that the larger the FCF available, the greater is the propensity to waste it. Thus, one benefit of paying a dividend is that the losses due to the FCF problem can be reduced. To balance this benefit, we introduce a dissipative cost, C, of paying a dividend. That is, it costs the firm d to pay a dividend of d, but its value to the shareholders is d[1-C]. It is natural to interpret C as a personal tax rate on ordinary income for the shareholders, but other interpretations are also possible.

Finally we assume that there is some probability that the manager will fail to recognize that there is a FCF problem. The idea here is similar to that in game-theoretic equilibrium concepts in which agents are allowed to deviate with some probability from the equilibrium strategy (e.g. Selten, 1975). More generally, we want to capture the possibility that managers have varying levels of sophistication when it comes to recognizing incentive problems within their firms and knowing how to deal with them. In our model, this affects only the G firms; the B firm has no FCF problem.

The probability that the manager will recognize the FCF problem and choose his dividend payment accordingly is $\gamma \in (0,1)$, and the probability that he will ignore the FCF problem in setting the dividend is 1- γ. We term managers that recognize the FCF problem as aware managers and managers that do not recognize the FCF problem as unaware managers. We assume 1- γ is very small, i.e., there is just a small probability of being unaware. In particular,

$\gamma > p$.

A.2 Analysis

We begin by establishing the first-best solution and then examine the equilibrium with asymmetric information and the FCF problem.

The manager's problem is

$$\underset{d}{Max} \quad aP_1(d,s) + b \times \sum_{i \in \{0,L,H\}} P_2(x{=}i,d,s)\Pr(x=i|\tau) - \sum_{i<d} \Omega[d-i]\Pr(x=i|i<d_2,\tau) \qquad \text{(2a)}$$

where P_1 depends on the dividend payment and the signal received by the market, and P_2 depends on the dividend payment, the signal and the cash flow observed by the market at t=2. Both the aware and unaware managers have equation (2a) as their objective function, but they use different price functions in their calculations.

A.2.1 First best

In this case there is no FCF problem and no asymmetric information. Thus, P=0 and there is no difference between the aware and unaware managers. Since the risk-free rate is zero and the firm's type ϑ at t=1 is known to the market, both P_1 and P_2 are identical. In this case, d has no signaling value and the manager maximizes

$$[a+b]\{qx_\tau + [1-q]\hat{x}_\tau - qdC - [1-q][d \wedge L]C\} - \sum_{i<d} \Omega[d-i]\Pr(x=i | i<d, \tau) \qquad (3a)$$

where {xϖy} means the minimum of x and y, τ is firm type, and

$$x_\tau = \begin{cases} H \text{ if } \tau = G \\ L \text{ if } \tau = B \end{cases}$$

$$\hat{x}_\tau = \begin{cases} L \text{ if } \tau = G \\ 0 \text{ if } \tau = B \end{cases}$$

The first component of equation (3a) indicates expected cash flows to the firm and the cost associated with any dividend payment d. When d > L, then the expected cost of the dividend becomes L[1-q]C. The second component of equation (3a) indicates the non-pecuniary penalty to the manager when the cash flow is less than the promised dividend d. It is apparent by examining equation (3a) that the first-best dividend level is:

$$d_\tau^O = 0 \qquad \forall \tau \in \{G, B\}.$$

The intuition is that there is a cost to paying a dividend but there is no benefit when there is symmetric information and no FCF problem.

A.2.2 Second best

We now assume that both the FCF problem and asymmetric information exist. We examine the behavior of firms conditional on the three realizations of the signal *s*.

Group 1 Firms (*s*=H):

When *s*=H, the firm is correctly and unambiguously identified as ϑ=G. Thus, there is no asymmetric information problem, and P_1 and P_2 are again the same. The manager's problem becomes maximizing $[a+b]P_1 - E[\Sigma\{d-x\} * x<d]$. The aware manager solves:

$$\underset{d}{Max} \left\{[a+b]\{q[H-d-f(H-L-d)]+[1-C]\{qd+(1-q)\,[d\varpi L]\}+[1-q]\{[L-d]\omega 0\}-[1-q][\Sigma\{d-L\}I_{\{d>L\}}(d)]\right\}$$

(4a)

where $I_{\{d>L\}}(d) = \begin{cases} 1\, if\;\; d > L \\ 0\, if\;\; d \le L \end{cases}$ and {xωy} means the maximum of x and y. Equation (4a) is similar to equation (3a) in that it has the firm's expected cash flows and the cost associated with the dividend d. However, now the aware manager must account for the loss in value due to the FCF problem when cash flows are high. Further, when d > L, the net expected cash flows are zero and the manager pays the non-pecuniary penalty.

If d > L, the first-order condition (FOC) for the optimal dividend payment, d^*, is:

$$q[f'(H - L - d^*)] - C = 0$$

which can be written as

$$f'(H - L - d^*) = \frac{C}{q}. \tag{5a}$$

The second-order sufficiency condition for an optimum is satisfied since

$f''(H - L - d^*)(-1) < 0$ because $f''(\bullet) > 0$.

If $d \le L$, the FOC becomes:

$$f'(H - L - d^*) = C + \frac{1-q}{q}\Omega. \tag{6a}$$

Now consider the unaware manager, who solves

$$\underset{d}{Max}\;\; \{q[H-d] + [1-C]\{qd + (1-q)[d\varpi L]\} + [1-q]\{[L-d]\omega 0\} - [1-q][\Sigma\{d-L\}I_{\{d>L\}}(d)]\} \tag{7a}$$

Equation (7a) shows that the unaware manager completely ignores the FCF problem and therefore only maximizes the expected future cash flows of the firm. Once again the manager faces the non-pecuniary penalty if d > L. Since equation (7a) is strictly decreasing in d, the unaware manager sets $d_I^* = 0$. For later use, let $\bar{x}_G = qH + [1-q]L$ and

$\sigma_G^2 = q[H - \bar{x}_G]^2 + [1-q][L - \bar{x}_G]^2$ be the mean and variance of the good firm's terminal cash flow. With this analysis we can state our first result.

Proposition 1: (1) In the second-best equilibrium, an aware manager in Group 1 always chooses a dividend level that exceeds that chosen by an unaware manager. (2) When a firm in Group 1 announces a dividend increase, there is a positive stock price reaction. (3) The average dividend paid by firms in Group 1 is γd^* and the cross-sectional variance in dividends is $(d^*)^2\,[1-\gamma]\,\gamma$.

Proof of Proposition 1:

(1) We prove above that $d^* > d_I^* = 0$.

(2) Note the price at time one for a firm with a rational manager, P_1^R,

$$P_1^R = \begin{cases} \bar{x}_G - qf(H-L-d^*) - d^*C & \text{if } d^* \le L \\ \bar{x}_G - qf(H-L-d^*) - C[qd^* + \{1-q\}L] & \text{if } d^* > L \end{cases} \tag{15a}$$

And the price at time one for a firm with an unaware manager, P_1^I, is

$$P_1^I = \bar{x}_G - f(H-L). \tag{16a}$$

$P_1^R > P_1^I$ whenever $d^* > 0$ because the only difference between the aware manager's utility and firm value P_1 is the penalty Σ associated with $d > x$. Thus, the d^* that maximizes the manager's utility must be lower than the d that maximizes P_1. This proves that $P_1^R > P_1^I$. The price of Group 1 after the market observes the signal *s* but before the dividend announcement is made is $\gamma P_1^R + [1-\gamma]P_1^I$. When the firm announces $d = d^*$, its price rises to P_1^R.

(3) The cross-sectional mean of the dividend paid by Group 1 firms is $\gamma d^* + [1-\gamma]d_I^* = \gamma d^*$. The fact that the variance is $(d^*)^2\,[1-\gamma]\,\gamma$ immediately follows. □

<u>Group 2 firms (*s*=L):</u>

These are firms with "moderate" past performance. In this group, the manager knows his firm's type, although the market is unsure of whether it is B or G. If the firm is B, the manager knows he does not need to pay a dividend to solve the FCF problem, since it does not exist. However, the G firm's manager may want to signal to separate himself from the manager of the B firm. To do this, the G firm's manager needs an incentive-compatible dividend payment.

Suppose d is the dividend. If the B firm's manager "reports" truthfully by choosing a dividend of zero, the manager's expected utility is:

$$[a+b]qL. \qquad (10a)$$

If the B firm's manager chooses to pay d (the dividend level chosen by the G firm's manager) his expected utility is[8]

$$a[\bar{x}_G - qf(H-L-d) - dC] + bq[L-dC] - [1-q]\Omega[d-L] \quad if\ d \le L \qquad (11a)$$

and

$$a[\bar{x}_G - qf(H-L-d) - C\{qd+[1-q]L\}] + bqL[1-C] - \Omega[d-L] \quad if\ d > L. \qquad (12a)$$

Thus, the incentive-compatible (IC) $\hat{d}$ using (11a) is

$$[a+b]qL = a[\bar{x}_G - qf(H-L-\hat{d}) - \hat{d}C] + bq[L-\hat{d}C] - [1-q]\Omega[\hat{d}-L]. \qquad (13a)$$

If we use (12a), the IC condition is:

$$[a+b]qL = a[\bar{x}_G - qf(H-L-\hat{d}) - C\{q\hat{d}+[1-q]L\}] + bqL[1-C] - \Omega[\hat{d}-L]. \qquad (14a)$$

The dividend that the G firm's manager chooses, d^{**}, is $\{d^* \ \omega\ \hat{d}\}$, where d^* is the dividend level that optimally copes with the FCF problem. The dividend amount selected to reduce the FCF problem depends on whether the manager is aware or unaware. If the manager is aware he chooses $d^*>0$, and if he is unaware he chooses $d^*=0$. Two cases are possible.

Case 1: $d^* > \hat{d} > 0.\}$

Case 2: $\hat{d} > d^* > 0.\}$

In Case 1, there are three dividend levels observed. The aware managers of the G firms pay d^* to simultaneously solve the incentive compatibility and FCF problems. The unaware man-

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[8] In the first-best solution, P_1 and P_2 are equal since we are examining prices in equilibrium. That is, P_1 is the expected value of P_2. However, in the second-best analysis, out-of-equilibrium moves are possible. Thus, P_1 and P_2 may not be equal.

agers of the G firms pay $\hat{d}$ to solve the incentive compatibility problem. The B firms' managers choose d=0.

In Case 2, there are two dividend levels observed. The aware as well as unaware managers of G firms choose $\hat{d}$ to cope with the incentive compatibility problem, and the managers of B firms choose d=0.

To state the following result, the equilibrium concept we use for the signaling game is the Sequential Equilibrium concept of Kreps and Wilson (1982), with the Universal Divinity refinement of Banks and Sobel (1987). Thus, we are viewing this as a game in which the informed manger moves first and the (relatively) uninformed market moves second.

Proposition 2: (1) In a Universally Divine sequential signaling equilibrium among Group 2 firms:

Case 1: The manger of the B firm pays no dividend. The aware manager of the G firm announces a dividend of $d^* > \hat{d} > 0$, and the unaware manager of the G firm announces a dividend of $\hat{d}$. The out-of-equilibrium belief supporting this equilibrium is that any firm choosing $d \neq \{d^*, \hat{d}\}$ is a B firm with probability one.

Case 2: The manager of the B firm pays no dividend. Both the aware and unaware managers of G firms announce dividends of $\hat{d} > d^* > 0$. The out-of-equilibrium belief supporting this equilibrium is that any firm choosing $d \neq \hat{d}$ is a B firm with probability one.

(2) Firms announcing $\hat{d}$ and d^* in Case 1 and $\hat{d}$ in Case 2 experience abnormal positive stock price reactions to the announcements. These reactions exceed that accompanying the announcement of d^* by firms in Group 1.

(3) The cross-sectional variance in dividend payments among Group 2 firms is higher than that among Group 1 firms.

(4) The cross-sectional variance in the cash flow at t=2 will be higher for the Group 2 firms than for the Group 1 firms.

We do not assume that firms remain unambiguously identified by the market over time. We allow for firm to be reclassified as a Group 2 firm, say, if the observed cash flows over time are moderate. However, if a G firm is reclassified from Group 1 to Group 2, we assume that the manager will change his dividend strategy in order to signal to the market and separate himself from the B firms that are not unambiguously identified by the market. Under this assumption, it is sufficient that the static optimization problem maximizes the firm's price at a single point in time.

Proof of Proposition 2: (1) Given the already established dividend payments for Cases 1 and 2, we need to establish that these dividend levels are part of a universally divine sequential equilibrium. Consider Case 1. If a firm chooses $d < \hat{d}$, then it is straightforward to show that the set of stock price responses for which it would be optimal for the manager to defect from his equilibrium dividend level is the largest for the manager of the B firm, in the sense that the sets of stock price responses for the rational and unaware managers of the G firms are nested within the set of responses for the B firm's manager. Using the universal divinity criterion, the market should assign a zero probability to the event that the defector is the manager of a G firm. Knowing this, no one defects. If $d \in (\hat{d}, d^*)$, it is clear that neither the B firm's manager nor the unaware manager of the G firm will defect even if the stock price response assigns the firm the same price as a G firm. It is not optimal for the aware manager of a G firm to defect. Similarly, no one defects with $d > \hat{d}$.

The equilibrium argument for Case 2 can be established along similar lines.

(2) The pre-dividend announcement price of all firms in Group G is $p[\gamma P_1^R + [1-\gamma]P_1^I] + [1-p]qL,$ where P_1^R and P_1^I are defined in (8a) and (9a). Consider Case 1. If a firm announces a dividend of $\hat{d}$, it is identified as a G firm with an unaware manager and

its post-dividend-announcement price becomes P_1^I. This exceeds the pre-dividend-announcement price for [1- γ] small enough. If a firm announces d^*, it is identified as a G firm with an aware manager and its price becomes P_1^R, which clearly exceeds the pre-announcement price.

Both these announcement effects exceed the announcement effect accompanying d^* for Group 1 firms as long as [1- γ] is small enough.

(3) It is clear for Case 1 that the cross-sectional variance of dividend payments is greater for Group 2 than for Group 1 since in Group 2 a fraction N_G γ of firms choose d^*, a fraction N_G[1- γ] of firms choose $\hat{d}$, and a fraction N_B of firms choose 0, whereas in Group 1 a fraction γ of firms choose d^* and a fraction [1- γ] choose 0.

(4) This part of the proposition is straightforward since there is greater heterogeneity of firms in Group 2 than in Group 1. □

Group3 (s=0):

All firms in this group have experienced poor financial performance and are correctly identified as B firms. Thus, none of these firms pays dividends, so that there is no cross-sectional heterogeneity in dividend payments among firms in this group. Since all firms are of the same type, the variance in the terminal cash flow is also low.

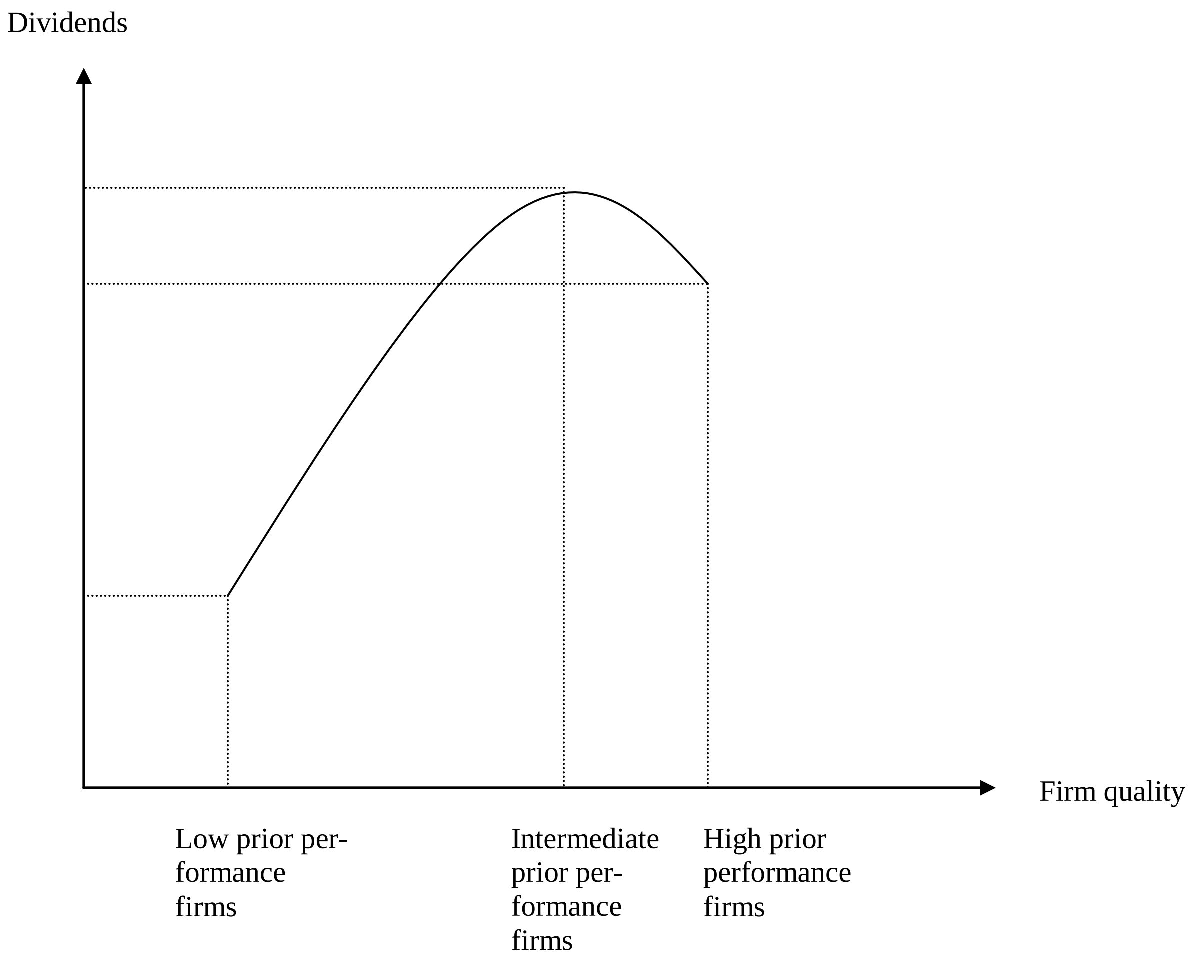

Figure 1

Dividends and firm quality

Table 1

Descriptive statistics for 2,197 NYSE, AMEX and Nasdaq-listed firms paying common-stock dividends, 1980–2000

The market value is the market capitalization as of December 31st each year based on shares outstanding and closing prices reported on CRSP. The book value is the year-end book value of total assets reported in Compustat. The dividend per share is the quarterly dividend per share of the firm reported on CRSP, and the dividend change is the difference in the current quarterly dividend per share and the previous quarterly dividend per share. The earnings change for the first, second, third, and fourth quarter after the dividend change is difference between the quarterly earnings for the first, second, third, and fourth quarter post dividend payment and the quarterly earnings in which the dividend is paid. The industry-adjusted earnings change for the first , second, third, and fourth quarter after dividend paid is the difference between the industry-adjusted quarterly earnings for the first, second, third, and fourth quarter post dividend payment and the industry-adjusted quarterly earnings in which the dividend is paid. Industry-adjusted quarterly earnings are measured as the firm's quarterly earnings minus the industry's quarterly earnings, where the industry is defined by the two-digit SIC code. All quarterly earnings data come from Compustat.

High prior performance group

Variable	Mean	Median	Minimum	Maximum
Market Value (in $000)	3,139,240	347,068	1,257	544,369,760
Book Value (in $000)	2,754,510	363,525	9,491	437,006,000
Dividend per share	$0.227	$0.165	$0.002	$1.900
Dividend change	$0.028	$0.020	$0.001	$0.873
Earnings change for 1st quarter after dividend paid	0.0029	0.0019	-0.5975	1.0551
Earnings change for 2nd quarter after dividend paid	0.0035	0.0023	-0.4143	0.8171
Earnings change for 3rd quarter after dividend paid	0.0049	0.0017	-0.4890	0.9563
Earnings change for 4th quarter after dividend paid	0.0039	0.0020	-0.8581	0.4618
Industry-adjusted earnings change for 1st quarter after dividend paid	0.0036	0.0026	-0.5949	1.0560
Industry-adjusted earnings change for 2nd quarter after dividend paid	0.0043	0.0028	-0.4117	0.8222
Industry-adjusted earnings change for 3rd quarter after dividend paid	0.0057	0.0021	-0.4839	0.9572
Industry-adjusted earnings change for 4th quarter after dividend paid	0.0047	0.0027	-0.8581	0.4607

Table 1 continued

Intermediate prior performance group

Variable	Mean	Median	Minimum	Maximum
Market Value (in $000)	3,399,120	533,112	1,7545	252,193,030
Book Value (in $000)	3,584,470	548,951	5,345	282,285,000
Dividend per share	$0.256	$0.200	$0.007	$1.900
Dividend change	$0.030	$0.020	$0.001	$0.980
Earnings change for 1st quarter after dividend paid	0.0059	0.0034	-1.8855	1.0267
Earnings change for 2nd quarter after dividend paid	0.0057	0.0036	-0.7136	0.6396
Earnings change for 3rd quarter after dividend paid	0.0058	0.0029	-0.3614	1.8865
Earnings change for 4th quarter after dividend paid	0.0059	0.0031	-0.4155	1.8924
Industry-adjusted earnings change for 1st quarter after dividend paid	0.0067	0.0044	-1.8817	1.0272
Industry-adjusted earnings change for 2nd quarter after dividend paid	0.0065	0.0042	-0.7098	0.6428
Industry-adjusted earnings change for 3rd quarter after dividend paid	0.0066	0.0038	-0.3544	1.8896
Industry-adjusted earnings change for 4th quarter after dividend paid	0.0066	0.0039	-0.4160	1.8955

Low prior performance group

Variable	Mean	Median	Minimum	Maximum
Market Value (in $000)	2,842,470	507,737	3,268	289,779,600
Book Value (in $000)	2,933,890	511,686	4,687	355,935,000
Dividend per share	$0.202	$0.170	$0.003	$1.700
Dividend change	$0.026	$0.020	$0.001	$1.300
Earnings change for 1st quarter after dividend paid	0.0024	0.0017	-0.9011	0.7323
Earnings change for 2nd quarter after dividend paid	0.0024	0.0016	-0.7458	1.2216
Earnings change for 3rd quarter after dividend paid	0.0029	0.0010	-0.8983	0.8629
Earnings change for 4th quarter after dividend paid	0.0023	0.0012	-0.5488	0.6804
Industry-adjusted earnings change for 1st quarter after dividend paid	0.0031	0.0021	-0.8986	0.7317
Industry-adjusted earnings change for 2nd quarter after dividend paid	0.0030	0.0022	-0.7464	1.2215
Industry-adjusted earnings change for 3rd quarter after dividend paid	0.0034	0.0016	-0.8957	0.8629
Industry-adjusted earnings change for 4th quarter after dividend paid	0.0029	0.0018	-0.5478	0.6794

Table 2

Difference in means and variance ratio tests for dividend and dividend yield

The sample contains 2,197 NYSE, AMEX and Nasdaq-listed firms with dividend payments between 1980 and 2000. To calculate the variance ratios the variance of the intermediate performance firms is divided by the variance of high performance or low performance firms, and the variance of the high performance firms is divided by the variance of the low performance firms.

Panel A: Differences of means

Prior performance group	Dividend	Dividend Yield
High	$0.172	2.247%
Intermediate	$0.213	2.963%
Difference	*$-0.041******	*-0.716%****
Intermediate	$0.213	2.963%
Low	$0.169	3.264%
Difference	*$0.044******	*-0.301%*
High	$0.172	2.247%
Low	$0.169	3.264%
Difference	*$-0.003*	*-1.017%******

Panel B: Variance ratio tests

Dividend		Unexpected dividend increase	
Prior performance groups	Variance ratio	Groups	Variance ratio
High vs. intermediate	1.235**	High vs. intermediate	1.144*
Intermediate vs. low	1.318**	Intermediate vs. low	0.571
High vs. low	1.067*	High vs. low	0.498

***, **, * indicates significance at the 1%, 5% or 10% level, respectively

Table 3

Difference in means and variance ratio tests for future quarterly earnings

The sample contains 2,197 NYSE, AMEX and Nasdaq-listed firms with dividend payments between 1980 and 2000. To calculate the variance ratios the variance of the intermediate performance firms is divided by the variance of high performance or low performance firms, and the variance of the high performance firms is dividend by the variance of the low performance firms.

Panel A: Differences of means

Prior performance group	Earnings change for 1st quarter after dividend paid	Earnings change for 2nd quarter after dividend paid	Earnings change for 3rd quarter after dividend paid	Earnings change for 4th quarter after dividend paid
High	0.0005	-0.0004	0.0008	0.0049
Intermediate	0.0001	0.0034	0.0059	0.0000
Difference	*0.0004*	*-0.0038****	*-0.0051****	*0.0049****
Intermediate	0.0001	0.0034	0.0059	0.0000
Low	0.0002	0.0006	0.0004	0.0000
Difference	*-0.0001*	*0.0029***	*0.0045****	*0.0000*
High	0.0005	-0.0004	0.0008	0.0049
Low	0.0002	0.0006	0.0004	0.0000
Difference	*0.0003*	*0.0010*	*0.0004*	*0.0049****

Panel B: Variance ratio tests

Earnings change for 1st quarter after dividend paid		Earnings change for 2nd quarter after dividend paid		Earnings change for 3rd quarter after dividend paid		Earnings change for 4th quarter after dividend paid	
Groups	Variance ratio	Groups	Variance ratio	Groups	Variance ratio	Groups	Variance ratio
High vs. intermediate	1.565***	High vs. intermediate	1.603***	High vs. intermediate	36.900**	High vs. intermediate	24.273***
Intermediate vs. low	1.235**	Intermediate vs. low	0.630	Intermediate vs. low	36.752**	Intermediate vs. low	70.341***
High vs. low	2.187***	High vs. low	1.046*	High vs. low	0.996	High vs. low	2.898***

***, **, * indicates significance at the 1%, 5% or 10% level, respectively

Table 4

Difference in means and variance ratio tests for future quarterly industry-adjusted earnings

The sample contains 2,197 NYSE, AMEX and Nasdaq-listed firms with dividend payments between 1980 and 2000. To calculate the variance ratios the variance of the intermediate performance firms is divided by the variance of high performance or low performance firms, and the variance of the high performance firms is dividend by the variance of the low performance firms.

Panel A: Differences of means

Prior performance group	Industry-adjusted earnings change for 1st quarter after dividend paid	Industry-adjusted earnings change for 2nd quarter after dividend paid	Industry-adjusted earnings change for 3rd quarter after dividend paid	Industry-adjusted earnings change for 4th quarter after dividend paid
High	-0.020	-0.021	-0.019	-0.016
Intermediate	-0.019	-0.016	-0.014	-0.021
Difference	*-0.001*	*-0.005*	*-0. 005*	*0.005*
Intermediate	-0.019	-0.016	-0.014	-0.021
Low	-0.029	-0.029	-0.028	-0.031
Difference	*0.010******	*0.013******	*0.014******	*0.010******
High	-0.020	-0.021	-0.019	-0.016
Low	-0.029	-0.029	-0.028	-0.031
Difference	*0.009****	*0.008****	*0.009**	*0.015******

Panel B: Variance ratio tests

Industry-adjusted earnings change for 1st quarter after dividend paid		Industry-adjusted earnings change for 2nd quarter after dividend paid		Industry-adjusted earnings change for 3rd quarter after dividend paid		Industry-adjusted earnings change for 4th quarter after dividend paid	
Groups	Variance ratio	Groups	Variance ratio	Groups	Variance ratio	Groups	Variance ratio
High vs. intermediate	1.729***	High vs. intermediate	3.196***	High vs. intermediate	3.436***	High vs. intermediate	0.565
Intermediate vs. low	1.242**	Intermediate vs. low	2.285***	Intermediate vs. low	2.551***	Intermediate vs. low	1.248**
High vs. low	0.718	High vs. low	0.715	High vs. low	0.742	High vs. low	2.208***

***, **, * indicates significance at the 1%, 5% or 10% level, respectively

Table 5

Average three-day cumulative abnormal returns around dividend announcements

The sample contains 2,197 NYSE, AMEX and Nasdaq-listed firms with dividend payments between 1980 and 2000. CAR is the average cumulative abnormal return from the trading day before through the trading day after the dividend announcement. The daily abnormal return is the firm's common-stock return minus the return of the CRSP value-weighted market index. To calculate the variance ratios the variance of the intermediate performance firms is divided by the variance of high performance or low performance firms, and the variance of the high performance firms is dividend by the variance of the low performance firms.

Panel A: Dividend- increase announcements	
Prior performance group	Three-day CAR
High	0.913%
Intermediate	0.564%
Difference	*0.349%******
Intermediate	0.564%
Low	0.230%
Difference	*0.334%******
High	0.913%
Low	0.230%
Difference	*0.683%******
	Variance ratio
High vs. intermediate	1.606***
Intermediate vs. low	1.947**
High vs. low	1.213**

Panel B: Dividend decrease announcements	
Prior performance group	Three-day CAR
High	-0.826%
Intermediate	-0.386%
Difference	*0.440%******
Intermediate	-0.386%
Low	-3.326%
Difference	*2.940%******
High	-0.826%
Low	-3.326%
Difference	*2.500%****
	Variance ratio
High vs. intermediate	1.028*
Intermediate vs. low	1.387**
High vs. low	1.349**

***, **, * indicates significance at the 1%, 5% or 10% level, respectively

Table 6

Differences in means of dividend and dividend yield partitioned by prior firm performance and dividend relative to performance group median

Prior firm performance and dividend relative to performance group	Dividend per share	Dividend yield
High performance, above median	\$0.178	2.169%
High performance, below median	\$0.168	2.398%
Difference	*\$-0.010*	*-0.229%*
High performance, below median	\$0.168	2.398%
Intermediate performance, above median	\$0.245	2.248%
Difference	*\$-0.077%***	*-0.150%*
Intermediate performance, below median	\$0.171	3.354%
Low performance, above median	\$0.169	2.968%
Difference	*\$0.002*	*0.386%**
Low performance, above median	\$0.169	2.968%
Low performance, below median	\$0.148	3.547%
Difference	*\$0.021*	*-0.579%***

***, **, * indicates significance at the 1%, 5% or 10% level, respectively

Table 7

Difference in mean dividend per share by prior firm performance

	Prior firm performance group				
	Low	Intermediate	High	Int. – low	Int. - high
1980-2000	\$0.169	\$0.213	\$0.172	\$0.044***	\$0.041***
1980-1981	\$0.221	\$0.288	\$0.242	\$0.067***	\$0.046***
1982-1983	\$0.200	\$0.247	\$0.227	\$0.047***	\$0.020**
1984-1985	\$0.185	\$0.233	\$0.212	\$0.049***	\$0.021***
1986-1987	\$0.172	\$0.213	\$0.201	\$0.041***	\$0.012*
1988-1989	\$0.165	\$0.212	\$0.200	\$0.047***	\$0.012*
1990-1991	\$0.162	\$0.197	\$0.207	\$0.035***	\$-0.010
1992-1993	\$0.146	\$0.182	\$0.174	\$0.037***	\$0.008
1994-1995	\$0.136	\$0.172	\$0.161	\$0.037***	\$0.012*
1996-1997	\$0.133	\$0.163	\$0.160	\$0.030***	\$0.003
1998-2000	\$0.127	\$0.149	\$0.145	\$0.021***	\$0.003

***, **, * indicates significance at the 1%, 5% or 10% level, respectively

Table 8

Fixed effects regressions explaining dividend and dividend yield

$$\Delta = \beta_1 \text{Low} + \beta_2 \text{Intermediate} + \beta_3 \text{High} + \beta_4 \text{Lsize} + \beta_5 \text{Mktbk} + \beta_6 \text{DivYld} + \text{error}$$

Δ is the dividend per share (Dividend column) or the dividend divided per share by the price per share one week before the announcement (Dividend Yield column), Low, Intermediate and High are dummy variables, each equal to 1 when the firm's prior performance is in the respective range, Lsize is the log of the market capitalization of the firm as of one month prior to the dividend announcement, Mktbk is the firm's market-to-book ratio one month prior to the dividend announcement and DivYld is the firm's dividend yield for the year before the dividend announcement. Year fixed effects are also included but not reported. P-values are in parentheses.

Explanatory variable	Dividend	Dividend Yield
Low	0.01628	0.00456
	(0.001)	(0.001)
Intermediate	0.01988	0.00474
	(0.001)	(0.001)
High	0.01434	0.00393
	(0.001)	(0.001)
Lsize	0.00087	0.00008
	(0.026)	(0.001)
Mktbk	-0.00049	-0.00056
	(0.504)	(0.001)
DivYld	-0.24791	0.87151
	(0.812)	(0.917)
N	79,989	79,989
Adjusted R^2	65.3%	91.4%
F	17.50	7077.60
	(0.001)	(0.001)

Table 9

Fixed effects regression explaining total firm payout

$$\text{TotalPay} = \beta_1\text{Low} + \beta_2\text{Intermediate} + \beta_3\text{High} + \beta_4\text{Lsize} + \beta_5\text{Mktbk} + \beta_6\text{TotalPay}_{-1} + \text{error}$$

TotalPay is the total payout of the firm (dividends plus repurchase) in year t in dollars, Low, Intermediate and High are dummy variables, each equal to 1 when the firm's prior performance is in the respective range, Lsize is the log of the market capitalization of the firm for year t-1 in thousands of dollars, Mktbk is the firm's market-to-book ratio for year t-1 and TotalPay_{-1} is the firm's total payout for year t-1 in dollars. Year fixed effects are also included but not reported. P-values are in parentheses.

Explanatory variable	Coefficient
Low	0.2516
	(0.165)
Intermediate	1.3971
	(0.001)
High	0.6373
	(0.031)
Lsize	0.0007
	(0.001)
Mktbk	-0.0012
	(0.215)
TotalPay_{-1}	0.9824
	(0.001)
N	37,137
Adjusted R^2	98.3%
F	215.61
	(0.001)

Table 10

OLS regressions explaining stock-price reactions around dividend announcements

The sample contains 2,197 NYSE, AMEX and Nasdaq-listed firms with dividend payments between 1980 and 2000. In the regression

$$\text{CAR} = \beta_1\text{Low} + \beta_2\text{Intermediate} + \beta_3\text{High} + \beta_4\text{Lsize} + \beta_5\text{Mktbk} + \beta_6\text{DivYld} + \text{error},$$

CAR is the three-day cumulative abnormal return of the stock, Low, Intermediate and High are dummy variables, each equal to 1 when the firm's prior performance is in the respective range, Lsize is the log of the market capitalization of the firm as of one month prior to the dividend announcement, Mktbk is the firm's market-to-book ratio one month prior to the dividend announcement and DivYld is the firm's dividend yield for the year prior to the dividend announcement. P-values are in parentheses.

Explanatory variable	Coefficient	
	Dividend-increase announcements	Dividend-decrease announcements
Low	0.01129	-0.02772
	(0.001)	(0.332)
Intermediate	0.01128	-0.00393
	(0.001)	(0.392)
High	0.01062	0.00415
	(0.001)	(0.001)
Lsize	-0.00189	-0.00003
	(0.001)	(0.978)
Mktbk	0.00146	0.00281
	(0.003)	(0.003)
DivYld	0.21008	-0.09408
	(0.001)	(0.022)
N	7,869	3,049
Adjusted R^2	2.81%	6.37%
F	38.99	35.55
	(0.001)	(0.001)