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Dividends and earnings: Their effect on firm value

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DIVIDENDS AND EARNINGS: Their Effect on Firm Value

by

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Abstract

DIVIDENDS AND EARNINGS: Their Effect on Firm Value

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This dissertation investigates the relation between firm value, dividends, and earnings. It develops a model of firm value which distinguishes between the operating activities of the firm, in which the average return on investment exceeds the marginal return, and the nonoperating activities, in which the average and marginal returns are equal.

Firm value is modeled as nonoperating assets plus the expected present value of future operating cash flows less the expected present value of the effective tax cost of future dividends. Differences in the tax treatment of dividends and capital gains between individual and corporate shareholders allows agreement on the level of the dividend payout rate to reduce agency costs. This agreement implies that firm value will also be a concave function of the payout rate. Regressing the market value at the ends of 1980 to 1987 of the common shares of 249 NYSE listed firms on proxies for the model's constructs yields parameter estimates generally in accordance with the predictions of the model, except for the estimate on effective dividend tax cost.

Assuming that the ratio of dividends to persistent operating cash flow is intertemporally constant and that operating cash flow is expected to grow at a constant rate implies that current dividends can proxy for both the expected present value of future operating cash flows and the expected present value of the effective tax cost of future dividends. Thus firm value equals nonoperating assets plus a multiple of dividends. This multiple, the dividend response coefficient, is an increasing function of the growth rate and a decreasing function of the dividend payout rate, the discount rate used in the present value calculation, and the effective tax rate on dividends.

Tests using the 1980-87 data of the same 249 firms generally support these predictions, except that those relating to the effects of the discount and tax rates on the dividend response coefficient are inconclusive.

The model is then used to analyze the effect of dividend and earnings announcements on firm value. The dividend and earnings response coefficients are shown to vary depending on which variable is announced first, and to vary as the rates noted above vary. Tests using quarterly 1981-87 data of 270 NYSE listed firms show marginally significant differences in the magnitude of the response coefficients due to the relative timing of the earnings and dividend announcements. The tests do support the predictions that the response coefficients would be larger the larger the growth rate and the smaller the interest and tax rates. Support for the predictions that the response coefficients would be smaller the larger the payout rate or beta is weak.

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INTRODUCTION

This dissertation presents three papers on the effect of dividends and earnings on firm value. Chapter 1 develops a model of firm value as an extension of the Miller and Modigliani (1962) and Ohlson (1990) models. The paper uses the model to analyze the effect on firm value of earnings and dividend announcements, including how this effect varies depending on the order of the two announcements, on firm specific rates (dividend payout rate, growth rate, discount rate), and on economy wide factors (interest rates and differences in the tax rates on dividends and capital gains).

Chapters 2 and 3 develop and test hypotheses based on the chapter 1 model. Chapter 2 examines the announcement date effects. Chapter 3 examines the relation between annual dividends and firm value as well as the relation between firm value and expected future cash flows and dividends.

In chapter 1, firm value is modeled as the expected present value of the firm's future cash flows less the tax costs to shareholders of expected future dividend distributions. Differences in the tax treatment of dividends and capital gains between individual and corporate shareholders allows agreement on the level of the dividend payout rate to reduce agency costs. This agreement implies that firm value will also be a concave function of the payout rate. Assuming that future cash flows from operating (real) assets are expected to grow at a constant rate permits firm value to also be expressed as nonoperating (financial) assets plus a multiple of current dividends. An analysis of the implications of earnings and dividends announcements on shareholders' expectations of the firm's future cash flows and dividends and therefore on firm value shows that the second announcement has less effect than the first, and that the effect is an increasing function of the persistence of the earnings surprise and the growth factor, and a decreasing function of the payout rate, the effective tax rate on dividends, and the discount rate.

Chapter 2 develops hypotheses predicting variations in announcement date earnings and dividend response coefficients as a function of: the relative timing of the two announcements, and variations in firm specific and economy wide variables. Analysis of the 1981-87 quarterly earnings and dividend announcements of 270 NYSE listed firms provides evidence that (1) the dividend response coefficient (i.e. the effect on firm value of an unexpected change in dividends) is greater than one; (2) the dividend response coefficient exhibits considerable variability: the lowest quartile being less than -9, and the highest quartile being greater than 26; (3) the earnings response coefficient (i.e. the effect on firm value of an unexpected change in earnings) is greater than zero; (4) the earnings response coefficient also exhibits variability: the lowest quartile being less than -1.7, and the highest quartile being greater than 2.6; (5) the dividend (earnings) response coefficient when dividends (earnings) are announced before earnings (dividends) is larger than when dividends (earnings) are announced after earnings (dividends), though the results are not always statistically significant; (6) earnings and dividend response coefficients are larger, the larger the growth rate; (7) earnings and dividend response coefficients are generally larger, the smaller the firm's beta; (8) earnings and dividend response coefficients are generally larger, the smaller the dividend payout rate; (9) dividend response coefficients are generally larger, the smaller the risk free interest rate; and (10) earnings and dividend response coefficients are generally larger, the smaller the tax rate on dividends compared to the tax rate on capital gains. The results suggest that in studies where the magnitude of the earnings or dividend response coefficient is of concern, the researcher needs to control for firm specific and economy wide variables and for the effect of other sources of information on the response coefficients. Even in studies where only the sign of the response coefficient is of concern, the researcher needs to consider the effect on the power of the regression tests of this variation in the response coefficients.

Chapter 3 examines how dividends affect firm value in three situations. First, when there are other sources of information about the firm's future cash flows, dividends are predicted to be inversely related to firm value. In the regressions, actual future cash flows and dividends proxy for currently expected cash flows and dividends. Dividends so proxied and firm value are found to be positively correlated when fewer than five years of future cash flows and dividends are used, but they are negatively correlated when more than six years of future cash flows and dividends are used and payout rates are also included in the regression.

Second, dividends are assumed to provide information about future operating cash flows. When firm value is regressed on dividends and there are no other proxies for future operating cash flows in the regression, dividends are predicted to be positively correlated with firm value. The results support this prediction.

Third, a similar positive relation between change in firm value and change in dividends is hypothesized. The empirical evidence on this hypothesis is mixed.

The paper also hypothesizes that the dividend response coefficient (the relation between firm value and dividends) when dividends provide information about future cash flows should vary across firms. The empirical evidence supports the hypotheses that the dividend response coefficient should be an increasing function of the dividend growth rate and a decreasing function of the dividend payout rate. The evidence with respect to the hypothesis that the dividend response coefficient should be a decreasing function of the firm's beta is mixed.

Chapter 1

DIVIDENDS, EARNINGS, AND FIRM VALUE

1.1 Introduction

Casual observation of the financial press indicates that among the most commonly reported announcements of publicly traded firms are those related to dividends and earnings. Although publicly traded firms are required to report considerable additional accounting data quarterly to the Securities and Exchange Commission, the financial press seems to focus primarily on dividend and earnings information.

Empirical studies (cited below) have reported positive correlations between a firm's earnings and its market value and between its dividends and its market value. The studies have used the level of the variables, their first difference, and/or unexpected changes in their level. The relation between earnings and market value has been examined both in event studies, which test the impact of earnings announcements on common stock returns over a short period, typically a few days, and in association studies, which test the correlation between earnings and market value over longer periods, typically a year.

The seminal work demonstrating a significant association between earnings and firm value was Ball and Brown (1968). Subsequent studies have documented that the announcement of an unexpected increase in earnings increases firm value. Bowen, Johnson, and Shevlin (1989) found the relation held even in the aftermath of the October 1987 market crash. A summary of this literature may be found in Watts and Zimmerman (1986 and 1990). Similar work in finance includes that of Divecha and Morse (1983), who found that the announcement of dividend increases was associated with positive abnormal returns during 1977-79. Patell and Wolfson (1984) found that the stock market reacts within minutes to earnings and dividend announcements.

Few studies have considered the effect of both earnings and dividend announcements. This is perhaps because early work by Watts (1973) on dividends and Gonedes (1978) on earnings and dividends found no economically significant relationship between dividend changes and future earnings (given current earnings). Whatever the reason, there appear to have been only six subsequent published studies in which firm value has been related to both earnings and dividends. Table 1.1 summarizes these studies.

Kane, Lee, and Marcus (1984) regressed cumulative abnormal returns on announced earnings divided by expected earnings from a time series model, percentage change in dividends, and dummy interaction terms. Using 352 observations of contemporaneous quarterly earnings and dividend announcements in 1979-81 they found that unexpected decreases in either earnings or dividends were associated with decreases in firm value. More importantly, their interaction terms, which were based on whether the earnings surprise was of the same sign as the dividend surprise or not, were generally more significant than were the percentage size of the surprises.

Kane, Lee, and Marcus examined the effect on firm value when the two announcements were made *within* a few days of each other. In contrast, Aharony and Swary (1980) studied 149 NYSE firms with dividend announcement dates from 1963-76 being at least 11 trading days *apart* from earnings announcement dates. They found that abnormal returns were significant and in the same direction as the dividend change regardless of whether earnings announcements preceded or followed dividend announcements. Abnormal returns were insignificantly different from zero when the announcement was for no change in dividends.

A working paper by Brown, Choi, and Kim (1992) examined the effect of dividend and earnings announcements on firm value. Their empirical results show that the second announcement is less informative than the first.

Livnat and Zarowin (1990) regressed annual cumulative abnormal returns for 1974-1986 on annual changes in components of the cash flow statement, including dividends. They reported a significantly positive coefficient on dividends, and coefficients on cash flow components generally consistent with their hypotheses.

Easton (1985) regressed the 1962 values of 349 firms (other than financial and insurance companies and utilities) on their 1962 dividends or on 1962 dividends and 1962 earnings. He used the present value of the dividend stream as a proxy for firm value and found a (marginally significant) positive slope for dividends alone, in apparent agreement with the results of the two previously cited studies. However when he regressed this proxy for firm value on both dividends and earnings, he found a significantly positive slope for earnings and a significantly *negative* slope for dividends.

Similarly, Downes and Heinkel (1982) found that, after controlling for earnings, the intention to pay dividends announced in the prospectus of an initial public offering *lowered* the offering price.

Not only are there few empirical studies in which firm value, earnings, and dividends appear in the same equation, there are also few models on which to base a study of their relation. The models of Ohlson (1990b) and Miller and Rock (1985), discussed in more detail in the following section, suggest that dividends provide little information beyond that in earnings. Such an implication appears to be contrary to the attention given to both announcements by the financial press and to the implications of the studies cited above.

The purpose of this paper is threefold:

1. to develop a model of firm value incorporating the information content of both dividends and accounting data,

2. to examine the effect of the relative timing of earnings and dividend announcements on firm value, and

3. to examine cross sectional and time series variation in the announcement date earnings and dividend response coefficients.

The model is based on previous work by Miller and Ohlson. It differs from their models in distinguishing between real (operating) and financial (nonoperating) assets and between the effect on firm value of earnings and of dividends. Expanding on prior work by Shleifer and Vishny (1986), the role of the dividend payout rate is explicitly considered.

The model merges financial economic theory with accounting terms and identities to add precision to the notion that firm value is the present value of future cash flows. It specifies which cash flows are most important and the direction and magnitude of the response of (changes in) firm value to changes in the flows. It offers an explanation for observing positive dividend response coefficients in some situations and negative ones in other situations.

The model is used to examine the effect on firm value of earnings and dividend announcements. Consistent with the empirical findings in the Brown, Choi, and Kim

(1992) paper, the analysis here indicates that the second announcement has a smaller effect on firm value than the first.

The effect on the announcement date dividend and earnings response coefficients of changes in the dividend payout rate, the discount rate, the effective tax rate on dividends, and the growth rate is then examined. The higher the dividend payout rate the higher is the tax cost of the dividend, which dampens the increase in firm value arising from the expected increase in future operating cash flows implied by an unexpected increase in earnings. The higher is the dividend payout rate the lower is the indicated increase in future operating cash flows implied by an unexpected increase in dividends. The larger the discount rate, the lower the present value of the indicated increase in future operating cash flows, and so the smaller the increase in firm value. The higher the tax rate, the higher is the tax cost of the dividend, which dampens the increase in firm value arising from the increase in earnings or dividends. The higher the growth rate, the greater is the effect on future operating cash flows of the increase in this period's persistent operating cash flows indicated by the unexpected increase in earnings or dividends, and so the greater is the increase in firm value.

Collins and Kothari (1989) obtain similar results to those here for the effect on the earnings response coefficient of changes in the discount rate and the growth rate. Their study is based on earnings response coefficients obtained by regressing returns over a year on unexpected earnings for the year (an association study); the current analysis predicts variations in the earnings response coefficients obtained by regressing returns on unexpected earnings on announcement days. No published work exists on the variation in the dividend response coefficient.

1.2 Literature review

This section reviews and discusses previous models of the determinants of firm value and the impact thereon of earnings and dividend announcements.

1.2.1 Firm value in a world of certainty

Miller and Modigliani (1961) argued that in an ideal economy firm value is the present value of future cash flows. They defined (p. 412) an ideal economy to be one with the following characteristics:

1. perfect capital markets where "no buyer or seller (or issuer) of securities is large enough for his transactions to have an appreciable impact on the then ruling price. All traders have equal and costless access to information about the ruling price and about all other relevant characteristics of shares. No brokerage fees, transfer taxes, or other transaction costs are incurred when securities are bought, sold or issued, and there are no tax differentials either between distributed and undistributed profits or between dividends and capital gains."
2. rational behavior, so that "investors always prefer more wealth to less and are indifferent as to whether a given increment to their wealth takes the form of cash payments or an increase in the market value of their holdings of shares."
3. perfect certainty where every investor has complete assurance "as to the future investment program and the future profits of every corporation."

Firm value V can then be written as the present value of next period's firm value plus next period's cash flows expressed either as dividends D to investors or as the firm's operating cash flow Y calculated as output less the inputs I for the following period[1]:

$$\begin{aligned} V_t &= \frac{V_{t+1} + D_{t+1}}{r_F} \\ &= \frac{V_{t+1} + Y_{t+1}}{r_F} \\ &= \frac{V_{t+1} + f_{t+1}(I_t) - I_{t+1}}{r_F} \end{aligned}$$

where f is the firm's production function relating output to the preceding period's inputs and $r_F > 1$ is the risk free rate of return. Since the equation is recursive in firm value V, firm value can be expressed as the present value of firm value at any future date plus the present value of cash flows in the intervening period. Subject to

[1] Note that Miller and Modigliani assumed that the selection of inputs is independent of dividend policy. If operating cash flow and dividends are not equal, the difference is assumed to represent the proceeds of the issue of additional common shares or the cost of repurchasing common shares.

certain regularity conditions, which Miller and Modigliani assert (p. 415) hold, the expression can be taken to the limit as:[2]

$$
\begin{aligned}
V_t &= \frac{D_{t+1}}{r_F} + \frac{D_{t+2}}{r_F^2} + \frac{D_{t+3}}{r_F^3} + \dots \\
&= \sum_{j=t+1}^{\infty} r_F^{t-j} D_j \\
&= \sum_{j=t+1}^{\infty} r_F^{t-j} Y_j.
\end{aligned}
$$

1.2.2 Firm value allowing some uncertainty

Some of the results obtained when the assumption of perfect certainty is dropped are documented in Fama and Miller (1972). They show (p. 298-302) that by replacing the perfect certainty assumption (# 3 above) with:

> 3′. investors have homogeneous expectations and are concerned with only the mean and dispersion of the return on investments,

firm value is the *expected* value of next period's firm value and dividends divided by the *expected* return:

$$
\begin{aligned}
V_t &= \frac{E_t\{V_{t+1} + D_{t+1}\} + cov\{V_{t+1} + D_{t+1}, Q_{t+1}\}}{r_F} \\
&= \frac{E_t\{V_{t+1} + D_{t+1}\}}{E_t\{r_{t+1}\}}
\end{aligned}
$$

where Q is the value of all assets in the market. The expected return on the investment $E_t\{r_{t+1}\}$ is given by the capital asset pricing model, and is a function of the covariance of the return on the investment in the firm with the market return.

Ohlson (1990b) derived a similar expression from a somewhat different set of assumptions, namely:

> 1. perfect capital markets (as above);
> 2″. uncertainty consists of a finite number of states, with probability $\Pi_s > 0$ that state s occurs;
> 3″. no arbitrage, i.e. there does not exist a portfolio of securities which is free (costless), but which generates a positive return in every state.

[2] The issue of the validity of taking the limit here is discussed later in this section.

Note that the Fama and Miller result permits an (uncountably) *infinite* number of states, but requires that the representative investor can assign a probability distribution to their occurrence based on a finite number (specifically two) of parameters, while the Ohlson result requires a *finite* number of states. Firm value from Ohlson's assumptions is then:

$$\begin{aligned} V_t &= \sum_s \{V_s + D_s\} R_s \\ &= \frac{E\{V_{t+1} + D_{t+1}\} + cov\{V_{t+1} + D_{t+1}, Q_{t+1}\}}{r_F} \end{aligned}$$

where $V_s + D_s$ is the liquidating dividend paid in state s in period t+1, R_s is the period t implicit price of a claim to one unit of liquidating dividends in state s in period t+1, and $Q_s = r_F R_s / \Pi_s$ is the implicit price normalized by the state probability and the risk free rate.

To generalize the model to several periods, Ohlson denotes the information available at date t as z_t. Values and dividends are now a function of the information:

$$V(z_t) = \sum_{z_{t+1}} [V(z_{t+1}) + D(z_{t+1})] R(z_{t+1}; z_t).$$

Recursively substituting

$$R(z_{t+u}; z_t) = \sum_{z_{t+u-1}} R(z_{t+u}; z_{t+u-1}) R(z_{t+u-1}; z_t)$$

gives

$$\begin{aligned} V(z_t) &= \sum_{j=t+1}^{T} \sum_{z_j} D(z_j) R(z_j; z_t) + \sum_{z_{T+1}} [V(z_{T+1}) + D(z_{T+1})] R(z_{T+1}; z_t) \\ &= \sum_{j=t+1}^{T} \frac{E\{D_j | z_t\} + cov\{D_j, Q_j | z_t\}}{r_F(j; z_t)} \\ &+ \frac{E\{V_{T+1} + D_{T+1} | z_t\} + cov\{V_{T+1} + D_{T+1}, Q_{T+1} | z_t\}}{r_F(T+1; z_t)} \end{aligned}$$

In Ohlson's equation 1 (p. 657) he implicitly asserts that taking the limit as T goes to infinity causes the last term to disappear so that firm value depends on the stream of dividends only.

Ohlson argues that in general the adjustment for risk must occur in the numerator, not in the denominator. However, he shows (p. 659) that if one assumes constant expected returns:

$$E\{\frac{V(z_{t+1}) + D(z_{t+1})}{V(z_t)}|z_t\} = r$$

then firm value equals the stream of dividends discounted by a risk adjusted discount rate:

$$\begin{aligned} V(z_t) &= \sum_{j=t+1}^{T} r^{t-j} E\{D_j|z_t\} + r^{T+1} E\{V_{T+1} + D_{T+1}|z_t\} \\ &= \sum_{j=t+1}^{\infty} [r_F + \sigma]^{t-j} E\{D_j|z_j\} \end{aligned}$$

where σ is the risk premium for the firm. Note again that the second equality derives from taking the limit as T goes to infinity in the first equality, and assumes that certain regularity conditions hold. The issue of the validity of taking the limit will be addressed later; for the time being the discussion will assume firms have a finite life.

Ohlson argues (p. 666-669) that future dividends are the only relevant variable in determining firm value. Miller and Modigliani (1961) argued that dividend policy is irrelevant. Their argument assumes that dividend policy is independent of investment policy, i.e. that the firm can issue or purchase common shares to equate the cash from operations to that needed for investment and dividends. The argument is clear where assumption 3 of perfect certainty holds. Once some uncertainty is permitted, then dividends may provide information about future investment programs and profits. As Miller and Modigliani stated [p. 430],

> ... in the real world a change in the dividend ... is often followed by a change in the market price ... . Such a phenomenon would not be incompatible with irrelevance to the extent that it was merely a reflection of what might be called the "information content" of dividends, an attribute of particular dividend payments hitherto excluded by assumption from the discussion and proofs. That is, where a firm has adopted a policy of dividend stabilization with a long-established and generally appreciated "target payout ratio", investors are likely to (and have good reason to) interpret a change in the dividend ... as a change in management's views of future prospects of the firm.

1.2.3 The effect of "earnings" and "dividend" announcements

Miller and Modigliani's point is discussed further in Miller and Rock (1985). Using the same assumptions 1, 2, and 3′ as in Fama and Miller, cum dividend firm value in a two period world is:

$$V_1 = D_1 + \frac{E_1\{f_2(I_1)\}}{r}$$

Note that Miller and Rock define negative "dividends" to be the proceeds of the issue of additional common shares at the ex dividend price; while firm value is the value of the firm to the original shareholders. The production function f is stochastic, and has a positive expected first derivative and a negative expected second derivative.

Since dividends equal operating cash flow,[3] cum dividend firm value can also be written as:

$$V_1 = f_1(I_0) - I_1 + \frac{E_1\{f_2(I_1)\}}{r}$$

Firm value is maximized if the marginal product at the optimal level of inputs I^* equals the discount rate, provided that average product at least equals marginal product:

$$\begin{aligned} E_1\{f_2'(I_1^*)\} &= r \quad if \;\; E_1\{f_2(I_1^*)\} > rI_1^* \\ I_1^* &= 0 \quad otherwise. \end{aligned}$$

Prior to disclosure of dividends, cash flow, and/or inputs, expected cum dividend firm value is:

$$E_0\{V_1\} = E_0\{f_1(I_0)\} - E_0\{I_1\} + \frac{E_0\{f_2(E_0\{I_1\})\}}{r}$$

To reduce the number of expectations operators, Miller and Rock make the following assumptions:

---

[3] Recall that this equality is implicit in how dividends and operating cash flow have been defined so far in this section.

4. Unconditional expected output is known to investors and intertemporally constant,[4] i.e.

$$\begin{aligned} E_0\{f_1(I)\} &= E_0\{f_2(I)\} \\ &= E_0\{f(I)\}, \forall I \end{aligned}$$

5. Unexpected output is independent of the level of investment, but is autocorrelated, i.e.

$$E_1\{f_2(I) - E_0\{f_2(I)\}\} = \gamma[f_1(I) - E_0\{f_1(I)\}], \forall I$$

and the correlation or persistence factor γ is known to investors.

Expected cum dividend firm value is now:

$$E_0\{V_1\} = E_0\{f(I_0^*)\} - I_1^* + \frac{E_0\{f(I_1^*)\}}{r}$$

After the output is announced, cum dividend firm value is:

$$\begin{aligned} V_1 &= f_1(I_0^*) - I_1^* + \frac{E_1\{f_2(I_1^*)\}}{r} \\ &= f_1(I_0^*) - I_1^* + \frac{E_0\{f(I_1^*)\} + \gamma[f_1(I_0^*) - E_0\{f_1(I_0^*)\}]}{r} \end{aligned}$$

The "earnings" announcement[5] effect is then:

$$V_1 - E_0\{V_1\} = [1 + \frac{\gamma}{r}][f_1(I_0^*) - E_0\{f_1(I_0^*)\}]$$

The earnings response coefficient, i.e. the effect of earnings on firm value, is $1 + \frac{\gamma}{r}$. Since "dividends" equal operating cash flow, unexpected dividends equal unexpected earnings equal unexpected output, and the dividend response coefficient equals the earnings response coefficient. Note also that if earnings are announced first, then there is no dividend surprise and no effect on firm value when dividends are announced.

[4] E.g., the production function can be expressed as a known nonrandom function of the inputs I which does not change over time plus (times) a stochastic term with mean zero (one).

[5] Miller and Rock do not distinguish between earnings as defined by current FASB definitions and earnings meaning output.

Similarly, if dividends are announced first, then there is no earnings surprise and no effect on firm value when earnings are announced. The earnings and dividend response coefficients are increasing functions of the persistence factor γ, and decreasing functions of the discount rate r.

Miller and Rock note that the model developed so far assumes that the firm chooses the optimal level of inputs which then determines the dividend level. Investors planning to sell their shares have an incentive to bribe management to declare a larger dividend, since this would increase their share value. The remaining shareholders would also receive the larger dividend, but would lose in the longer run, since the only way the firm can pay a larger dividend is to reduce inputs below the optimal level. Miller and Rock argue that any solution to this problem will be characterized by less than optimal inputs.

1.2.4 Discussion

The Miller and Rock model is unsatisfying for a number of reasons. It suggests that the second announcement contains no information. As discussed in the introduction, both Kane, Lee, and Marcus (1984) and Brown, Choi, and Kim (1992) found that the second announcement did have an effect on firm value at least in some cases. The model also implies (p. 1036) a 100% payout rate, i.e. that "dividends" equal operating cash flow which equals earnings under assumption 4. Miller and Rock have some discussion of these points (e.g. p. 1037), though their explanation mostly involves noting that "dividends" mean any transactions between the firm and its shareholders, i.e. "dividends" equal dividends less financings. Since they seem to dismiss any empirical rejection of their model based on this definition of dividends, it introduces another point of dissatisfaction, namely that their model may not be refutable empirically. Finally, their statement (p. 1032) that uncertainty necessarily prevents first best input selection cannot be left unchallenged.

As noted in the quote from the Miller and Modigliani paper, many firms have target payout rates, which rates are generally much less than 100%. If operating cash flow equals earnings, yet firms' payout rates are less than 100%, then where is the rest of the cash going? In the Miller models discussed above, the excess cash is apparently used to purchase treasury shares. Yet there is no empirical evidence of such large scale purchases. If the payout rate is measured relative to earnings, which are less than operating cash flows, then the excess cash could be being reinvested. However, this suggests that the dividend payout decision and the input selection decision are in fact one and the same decision, which is contrary to the evidence in Lintner (1956) and Baker et al (1985). Therefore there must be another use of cash not identified in these simple models. The excess cash could be used to redeem debt or preferred shares, or it could be invested in zero net present value assets such as Treasury Bills.[6] In the rest of this paper these net assets will be called nonoperating or financial assets. Introducing this additional use of cash means that management can be assumed to select the optimum level of inputs (i.e. investment in real assets) that is determined using the firm's production function, that it can then select the level of dividends to pay, and that the remaining cash is invested in (or obtained from, in the case that optimum investment in real assets plus dividends exceeds the operating and nonoperating cash flow,) the nonoperating (financial) assets.

If a firm has a finite life, then cash flow not immediately distributed as dividends is invested in nonoperating assets, which can be distributed in the liquidating dividend at the end of the firm's life. However, if the firm lives forever, which is what is implied when firm value is equated to the present value of an infinite stream of dividends,[7] then there may never be a liquidating dividend.

What is the effect on firm value of a change in the payout rate? The Miller Modigliani dividend irrelevance theorem states that such a change should have no effect. As the payout rate decreases, nonoperating assets and earnings increase, which may imply an eventual increase in dividends. However, such an eventual increase seems to result from an assumption not explicitly made in the above models, namely that in the limit the ratio of dividends to some measure of income is greater than zero. In the absence of such an assumption, it is possible that the present value of the stream of future dividends decreases as the payout rate decreases, though firm value measured in other ways[8] is unaffected.

The model developed in the following section attempts to measure firm value using assumptions similar to those discussed above, but without the defects noted above.

[6] As Myers and Majluf (1984) note, without the kind of a financial slack characteristic of assets such as Treasury Bills, the firm may pass up positive net present value projects.

[7] And implied in GAAP's going concern assumption.

[8] E.g. as the present value of the firm's future cash flows.

Specifically, it retains either the Fama and Miller assumptions 1, 2, and 3′ or the Ohlson assumptions 1, 2″, and 3″. It permits firm value to be expressed as a function of financial (nonoperating) assets and *either* operating cash flow or dividends. It shows that when dividends are announced after earnings (or vice versa) the second announcement in general *does have an effect* on firm value (though the effect is smaller than if the item had been announced first).

1.3 The model

This section develops a model of firm value as a function of cash flows, dividends, and related parameters. The value of two unincorporated businesses, one with only real assets, one with only financial assets, is first derived; then the businesses are amalgamated into a corporation whose merged value is determined. Assume that the businesses operate in an ideal economy with (limited) uncertainty implied by either the Fama and Miller characteristics 1, 2, and 3′ or the Ohlson characteristics 1, 2″, and 3″. Assume for simplicity that the proportionate interest in the businesses of each of its owners does not change. Notation is summarized in table 1.2.

1.3.1 An operating company

Consider a business producing widgets. Assume periodic output is a stochastic, concave function f of the input I.[9] Period t operating cash flow is the output at the end of the period less the input for the following period:

$$Y_t = f_t(I_{t-1}) - I_t.$$

The value of the business at time t is the present value of the future operating cash flows:

$$\begin{aligned} V_t &= E_t\{\frac{Y_{t+1}}{r} + \frac{Y_{t+2}}{r^2} + \frac{Y_{t+3}}{r^3} + \ldots\} \\ &= E_t\{\sum_{j=t+1}^{\infty} r^{t-j} Y_j\} \end{aligned} \tag{1.1}$$

[9] More generally output could be a function of all previous inputs. Such a generalization would add little to the insights of the model while considerably complicating the notation. The production function is assumed to have a positive expected first derivative and a negative expected second derivative.

where $r > 1$ is the "appropriately risk-adjusted discount factor for the business' expected earnings"[10] and E denotes the expectations operator. Value is maximized if the marginal product at the optimal level of inputs I^* equals the discount rate, provided that average product at least equals marginal product:

$$\begin{aligned} \forall j > 0 : E_t\{f'_{t+j+1}(I^*_{t+j})\} &= r \quad \textit{if} \;\; E_t\{f_{t+j+1}(I^*_{t+j})\} > rI^*_{t+j} \\ I^*_{t+j} &= 0 \quad \textit{otherwise.} \end{aligned} \tag{1.2}$$

Table 1.3 provides a numerical example. The production function[11] is not stochastic and does not vary through time:

$$f_{t+1}(I_t) = -1.75 + 9.9\log(I_t)$$

The optimum level of input determined by equation 1.2 is $I = \$9.00$ which gives output of \$20.00. Firm value is \$110.00, being the present value at a discount rate of 10% of an annuity paying \$11.00 at the end of each period forever. Note that the higher the discount rate, the lower is firm value.[12]

The business requires an initial investment of \$9.00, which produces cash flow of \$11.00 each period forever. The book value of the business at the end of each period is \$9.00, the optimum input for the following period. The model does not discuss how the initial entrepreneur obtained such a fortunate investment opportunity. Presumably in reality, the production process summarized in the production function requires a substantial investment of time and talent by the initial entrepreneur. Such research and development costs might have appeared in the financial statements of the business but, since they are constant sunk costs, they are ignored in the model.

Once the viability of the business has been established and the initial investments made, the initial entrepreneur could sell the company to another investor for the firm

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[10] Assuming the discount rate r is intertemporally constant imposes constraints on how the probability distribution of the production function f can vary over time. See Ohlson's comments summarized previously. Assume without loss of generality that operating cash flow Y is computed net of any tax on the business' cash flow, and that the discount rate r is the appropriate discount rate to apply to cash flows after allowing for any capital gains tax applicable to receipt of those flows.

[11] See Varian (1984, P. 76) for a similar production function.

[12] The higher the discount rate, the lower the present value of each period's cash flow. Higher discount rates also imply lower optimum inputs which in turn imply lower periodic cash flows.

value V of \$110.00. Since the book value immediately before this transaction would still be only \$9.00, the cost of the optimum input, the excess of the purchase price over the book value, \$101.00, would be recorded as goodwill. Note that the excess of firm value over input cost is the same at the end of each period, but that generally accepted accounting principles require the goodwill to be amortized to income over a period not exceeding 40 years.[13]

The model assumes that the input is selected at the end of each period, that production occurs over the following period, and that the output is sold at the end of that period. For most firms, production is continuous, with inputs being purchased and output being sold more or less continuously. Moreover the required frequency of purchase varies among inputs. Raw materials recorded as part of inventory may be purchased weekly, while property and plant is purchased much less frequently, possibly once a decade. Financial statements treat different inputs differently, purchase of inventory being included in operating activities and purchase of property and plant being included in investing activities. In this paper, all activities related to the production function are classified as operating; all inputs are assumed to be purchased at the end of an operating period and to be fully consumed by the end of the following period.[14]

When the production function is intertemporally constant, period t earnings equal period t operating cash flow. More generally, operating cash flow differs from earnings by the difference between opening and closing inputs, since period t earnings equals the output at the end of period t less the input at the *beginning* of the period:

$$f_t(I_{t-1}) - I_{t-1}.$$

[13] GAAP effectively assumes that the growth rate g of such an acquired business will always be < 1. Goodwill is not the only intangible asset whose measurement subsequent to acquisition is based more on a belief that it must have a finite useful life to be amortized to income than on an attempt to estimate periodically its value to the business.

[14] As noted previously, generalizing the production function so that output would be a function of the inputs of several periods would add little to the model's insights while considerably complicating the analysis and notation.

Table 1.4 illustrates this difference. The production function is[15]:

$$f_t(I_{t-1}) = g^t[0.30 - 8.65(t-1)\log(g) + 8.65\log(I_{t-1})]$$

where the growth rate $g = 1.07$. The optimum level of input and output grow at 7% per period. Operating income differs from operating cash flow by the amount of the increase in operating expenditures, which are the operating assets at the end of each period. As in the previous table, operating assets are selected at the end of each period in accordance with equation 1.2 to maximize firm value. Firm value V_t is the present value of the future operating cash flows. It is smaller the larger is the discount rate.

Firm value grows each period by the growth rate. The larger is the growth rate, the larger is firm value. The return is calculated as the operating cash flow which is distributed to the owner plus the increase in firm value. Note that as a percentage of opening firm value, the return equals the discount rate (*not* the growth rate).

1.3.2 An investment company

In the preceding subsection, the firm was assumed to invest in real assets, i.e. inputs to a production function characterized by decreasing expected marginal returns. In this subsection, the firm is assumed to invest in financial assets, i.e. inputs to a "production" function characterized by constant expected marginal returns. Investment in real assets can be thought of as investment in inventory, plant, and equipment; investment in financial assets can be thought of as investment in marketable securities.

Period t cash flow is the "output" determined by the "production" function h less the input C for the following period:

$$Y_t = h_t(C_{t-1}) - C_t.$$

The value of the business at time t is the present value of the future cash flows:

$$\begin{aligned} V_t &= E_t\{\frac{Y_{t+1}}{r} + \frac{Y_{t+2}}{r^2} + \frac{Y_{t+3}}{r^3} + ...\} \\ &= E_t\{\sum_{j=t+1}^{\infty} r^{t-j}Y_j\} \end{aligned}$$

[15] Note that setting $g = 1$ would give a function whose form is similar to that used in the preceding table.

where $r > 1$ is again the "appropriately risk-adjusted discount factor for the business' expected earnings" and E denotes the expectations operator.[16] Value is maximized if the marginal product at the optimal level of inputs C^* equals the discount rate,

$$\forall j > 0 : E_t\{h'_{t+j+1}(C^*_{t+j})\} \;=\; r$$

But the expected marginal product is assumed to be constant, so that either any level of investment C is optimal or no investment is optimal. Assuming some investment is optimal, then the "production" function must satisfy:

$$E_t\{h_{t+j+1}(C_{t+j})\} = E_t\{r'_{t+j+1}C_{t+j}\} = rE_t\{C_{t+j}\} = r^j C_t$$

and firm value is simply[17]:

$$V_t = C_t.$$

By assumption, the nature of the investment business differs substantially from that of the operating business. Its expected output rC_t is related linearly to its input C_t, whereas the operating business' output is related to its input I_t by a stochastic production function which may vary through time. For the investment business, expected average and marginal returns are equal; for the operating business expected average return exceeds marginal return at the optimal level of input. For the operating business, there is a unique level of input (operating assets) each period which is optimal; the model assumes that the rest of the preceding period's output is distributed to the owner. For the investment business, any level of input (nonoperating assets) is equally optimal; and so any part of the output can be distributed to the owner. For both businesses, what is not distributed becomes the input for the following period, and the period's cash flow equals the amount distributed. Firm value equals both the present value of expected future cash flows and the present value of expected future dividends. Output at the end of each period equals the amount distributed at the end of the period plus the input for the following period. For the operating business, the optimum level of inputs determines the cash flow which equals the amount distributed; for the investment business, there is no optimum input level, so that the amount distributed is not constrained.

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[16] Y denotes the cash flow from investing in financial assets in this subsection only. In the rest of the paper, Y denotes the cash flow from investing in real assets, as noted in table 1.2.

[17] This is transparently obvious given Ohlson's no arbitrage assumption.

1.3.3 Combining the businesses

Assume the firm has two businesses: one investing in real assets (producing widgets) and one investing in financial assets.[18] The earnings, cash flows, and value of the firm are the sum of the respective amounts of the two businesses[19]:

$$
\begin{aligned}
\text{Earnings: } X_t &= r'_t C_{t-1} - C_{t-1} + f_t(I_{t-1}) - I_{t-1} \\
\text{Cash flows: } & \quad r'_t C_{t-1} - C_t + Y_t \\
\text{Firm value: } V_t &= C_t + E_t\{\sum_{j=t+1}^{\infty} r^{t-j} Y_j\}
\end{aligned} \tag{1.3}
$$

Table 1.5 continues the numerical example, though the firm's initial equity is increased to \$18.41. The production function (for the operating portion of the business) is the same as in the preceding table so that optimal inputs, operating cash flow, operating income, and cash flow distributed are unchanged. The excess of the initial equity over the initial optimum operating (real) assets is invested in nonoperating (financial) assets. The example assumes that none of the nonoperating income is distributed so that investment cash flow is zero. Firm value equals the value of the operating business (as shown in the previous table) plus the value of the nonoperating (financial) assets.

As before, firm value increases as either the growth rate increases or the discount rate decreases. Return, which equals the cash flow distributed to the owner plus the increase in firm value, is the same percentage of opening firm value as the discount rate (*not* the growth rate). The 7.1% growth in firm value is a weighted average of the growth rate for the operating business and the discount rate (which is the rate at which the nonoperating (financial) assets grow); the weight is a function of the initial endowments of operating and nonoperating assets.

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[18] Recall that although the expected marginal return on both investments is r, the expected average return on investing in real assets exceeds the expected marginal return, while the expected average return on investing in financial assets equals the expected marginal return. The realized rate of return on the financial assets in period t is r'_t.

[19] Assuming their cash flows are uncorrelated. Note also that the value of the firm does not depend on the expected rate of return of the investment business, provided that the rate is optimal for the level of risk assumed.

1.3.4 The effect of dividend and capital gain taxes

Assume the owner decides to incorporate the firm. Modify the perfect capital markets assumption 1 to permit a non-zero tax cost at some rate T to be imposed on shareholders representing the difference between the tax rate on dividends and the present value of the tax rate on the capital gains that the shareholders would otherwise have incurred to obtain the same amount of cash when they needed it. Since the value of the incorporated firm should reflect the tax cost, firm value from equation 1.3 must be adjusted by subtracting the present value of the dividend tax cost[20] from the assets held by the investment business (hereafter called financial or nonoperating assets) and the present value of the operating cash flow:

$$V_t = C_t + E_t\{\sum_{j=t+1}^{\infty} r^{t-j}Y_j\} - E_t\{\sum_{j=t+1}^{\infty} r^{t-j}D_jT_j\} \tag{1.4}$$

Several comments on equation 1.4 are appropriate. In the ideal economy with no effective tax rate on dividends ($T = 0$), investors have the same expectations (assumption $3'$ or $2''$) and compute the same firm value. More generally, the equation can be viewed as providing the value of a particular firm at a particular time to a particular investor. Those investors who hold shares in the firm presumably do so because their computation of the value of the firm equals or exceeds the market value. Expectations of future operating cash flows and dividends vary among investors. Their discount rates also vary because of differences in their preferences for current versus future consumption and their perceptions of the riskiness of the firm's prospects.

Investors' effective tax rate T on dividends will vary depending upon their tax status, the dates at which they expect to realize cash from their investments, and the dividend and capital gain tax rates in effect at the dates they need to realize cash on their investment. Tax exempt entities such as charities and pension funds will have zero effective tax rate on dividends. Individuals' effective tax rate on dividends will be positive and will be larger the higher the marginal tax bracket of the individual and the greater the length of time between the date the dividend is received and the date the cash is required for consumption. Miller and Scholes (1978) argued that investors

[20] This point raises the question as to why firms incorporate or pay dividends. The latter question is discussed in section 1.3.5.

can shelter their dividend income by leveraging their purchases and can shelter their capital gains by transferring their holdings tax free to spouses or children.

The sign of the effective tax rate on dividends for investors which are corporations is unclear. Generally corporations face a lower tax rate on dividends received than on capital gains realized. However if the date they expect to liquidate their investment is sufficiently far in the future, the present value of the capital gains tax may be less than the dividend tax.

Theoretically then, the sign of the effective tax rate on dividends, T, implicit in firm value depends on the type of the marginal investor. The sign may be discerned by observing the ex dividend date behaviour of share prices. If the share price were to decline by less than the amount of the dividend, $T > 0$ would be indicated. If the share price were to decline by more than the amount of the dividend, $T < 0$ would be indicated. Most studies (e.g. Elton and Gruber, 1970) have observed evidence consistent with the case $T > 0$, which is the assumed sign of T in the rest of the paper.

Table 1.6 shows that increasing the effective dividend tax rate T decreases the firm value and returns of the combined business. The accounting information given in the rows labelled "operating revenue" to "equity" is the same as in table 1.5. Firm value has decreased in each period by the tax cost which equals the dividend tax rate times the value of the operating business. The change in time 0 firm value is $\$376.67 - \$266.67 = \$110.00 = 30\% * \$366.67$; the change in time 1 firm value is $\$403.34 - \$285.63 = \$117.71 = 30\% * \$392.34$; and so on.

Table 1.7 shows that reducing the dividend payout rate (the percent of the operating cash flow distributed to the owners) increases firm value and returns by decreasing tax costs. The operating cash flow retained increases each period's nonoperating assets and investment income. The value of the operating business is still reduced from that in table 1.4 by the dividend tax cost, but the value of the investment business is increased by the cash retained. Thus time 0 firm value equals the nonoperating assets plus the time 0 value of the operating business less the dividend tax cost: $\$354.67 = \$10.00 + \$366.67 * [1 - .20 * .30]$; the time 1 firm value is $\$388.59 = \$19.80 + \$392.34 * [1 - .20 * .30]$; and so on.

Table 1.8 shows the effect of eliminating the growth in operations. Nonoperating assets and firm value continue to increase because some of the operating cash flow and all of the nonoperating income are retained and invested in nonoperating assets. Note that the following relations hold regardless of the levels of the parameters assumed. The percentage return, calculated as the return divided by the previous period's firm value, equals the discount rate. The growth in firm value is a weighted average of the growth rate and the discount rate; the weight is a function of the initial endowment of nonoperating assets, the payout rate and the effective tax rate on dividends.

Firm value as given in equation 1.4 equals the present value of expected future dividends if the dividend payout rate on both operating and investing income is positive. If either is zero, then the present value of expected future dividends misstates firm value. For example, in table 1.5 dividends equal operating cash flow, but the payout rate on the investment income is zero. Thus $Y_t = D_t$, but firm value differs from the present value of expected dividends by the amount of the nonoperating (financial) assets.

Returning to the model, from equation 1.4 the standard result that firm value is the discounted expected value of next period's firm value plus after tax dividends can be derived:

$$\begin{aligned} V_t &= C_t + E_t\{\sum_{j=t+1}^{\infty} r^{t-j}Y_j\} - E_t\{\sum_{j=t+1}^{\infty} r^{t-j}D_jT_j\} && (1.4) \\ V_{t+1} &= C_{t+1} + E_{t+1}\{\sum_{j=t+2}^{\infty} r^{t+1-j}Y_j\} - E_{t+1}\{\sum_{j=t+2}^{\infty} r^{t+1-j}D_jT_j\} \\ &= r'_{t+1}C_t + Y_{t+1} - D_{t+1} + E_{t+1}\{\sum_{j=t+2}^{\infty} r^{t+1-j}Y_j\} - E_{t+1}\{\sum_{j=t+2}^{\infty} r^{t+1-j}D_jT_j\} \\ V_t &= E_t\{V_{t+1} + D_{t+1}[1 - T_{t+1}]\}/r. && (1.5) \end{aligned}$$

Note that firm value (cum after tax dividends) grows at rate r, even though no constraints on the growth in operating cash flow and dividends have yet been imposed.

The cum after-tax dividend change in firm value equals the nonoperating earnings plus the change in the expectations of the present value of the operating cash flow net of the tax cost of dividends:

$$\begin{aligned} V_{t+1} + D_{t+1}(1 - T_{t+1}) - V_t &= [r-1]V_t + [r'_{t+1} - r]C_t \\ &+ \{E_{t+1} - E_t\}\{Y_{t+1} - D_{t+1}T_{t+1} + \sum_{j=t+2}^{\infty} r^{t+1-j}[Y_j - D_jT_j]\} \\ &= [r'_{t+1} - 1]C_t + \{rE_{t+1} - E_t\}\{\sum_{j=t+1}^{\infty} r^{t-j}[Y_j - D_jT_j]\} \quad (1.6) \end{aligned}$$

Summarizing, the model has shown that firm value is an increasing function of expected future operating cash flows and a decreasing function of expected future dividends (equation 1.4) because of the tax penalty. If expectations do not change, returns are an increasing function of future operating cash flows and a decreasing function of the future dividend tax cost (equation 1.6). If future cash flows and dividends are expected to equal current cash flows and dividends, then equation 1.4 states that firm value equals current net earnings less the tax cost of the current dividend all divided by $r-1$. The signs of this prediction are supported by the results in Easton (1985, table 3b) and Downes and Heinkel (1982), cited in table 1.1, but the magnitudes predicted have not been tested. On the other hand, the predicted sign of the dividend response coefficient in equation 1.6 is not supported by the Livnat and Zarowin (1990) study cited in table 1.1. These predictions are based not only on the model but also on the assumption of the naive expectations that the best predictor of future earnings is current earnings and the best predictor of future dividends is current dividends. What is particularly naive and unsatisfactory about this expectation model is that it assumes that current dividends provide no information about future earnings. The next section remedies this deficiency.

1.3.5 The effect of dividend payout policy

The purpose of this section is to extend the model by showing how dividends can provide information about firm value. It is based on previous work by Shleifer and Vishny (1986), who propose that dividends are a necessary part of a cost effective monitoring device, and that the dividend payout rate is set based on a trade-off between tax costs and the benefits of encouraging corporate monitoring efforts.[21] [22]

Equation 1.4 states that firm value equals nonoperating assets plus the expected

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[21] Note that Shleifer and Vishny did not distinguish between operating and nonoperating cash flow, between income and cash flow, nor between dividends and payout rates.

[22] It is possible that the results of this subsection could be obtained from quite a different set of assumptions. For instance, an optimal payout rate might be determined by trading-off the costs of excessive financial slack as proposed by Jensen (1986) with the costs of insufficient financial slack as proposed by Myers and Majluf (1984). The argument that a change in dividends relates to a persistent change in earnings or cash flow agrees with the policies espoused by the managers interviewed by Lintner (1956) and Baker et al. (1985). See the appendix for additional discussion of previous work in this area.

present value of future operating cash flows less the expected present value of the tax cost of future dividends. For firm value to change, one of these terms must change. Nonoperating assets reflect the past performance of the firm; they could only be changed currently by issuing or redeeming shares. Such an action would change firm value, but would not change firm value per share (ignoring the transaction costs of the issue or redemption).

As argued in Shleifer and Vishny (1986), some managers, despite their best efforts, may not be able to maximize firm value. If a shareholder can identify a way to increase firm value, he must either persuade management to make that change, or persuade his fellow shareholders to install new management. Such a shareholder bears the entire cost of his effort, but he only obtains a proportion of the increase in share value, where the proportion is determined by his shareholdings. The amount of his effort is therefore an increasing function of his shareholdings in the company. He could of course first identify the way of increasing firm value, and then purchase additional shares so as to increase his proportion of the increase in share value. However in many jurisdictions there are legal restraints on how many shares an investor can purchase without disclosing his intentions. Even in the absence of such formal constraints, his purchases are likely to drive up the share price[23] and so inhibit his ability to keep the whole benefit to himself.

To formalize the preceding discussion, call such a shareholder a monitor. Following Shleifer and Vishny (1986), assume that the increase in the expected value of the firm's operating cash flows is a stochastic function G of the cost of the monitor's effort J. Assume the expected first derivative of G is positive and the expected second derivative is negative. If a represents the proportion of the firm's shares held by the monitor, then the monitor's profit is maximized[24] if the marginal increase in its share of the increase in firm value equals the marginal cost of the effort:[25]

$$aG'(J^*) = 1.$$

Totally differentiating the equation and using the second order condition shows that

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[23] This may occur because the supply curve of shares is upward sloping or because his purchases (or the increased share volume) may reveal his intentions.

[24] The monitor selects J^* to maximize $aG(J) - J$.

[25] The expectations operator is suppressed in the following equations to avoid clutter.

the optimal level of effort J^* is an increasing function of the proportion a of the shares owned by the monitor:

$$\begin{aligned} G'(J^*) + aG''(J^*)J^{*\prime}(a) &= 0. \\ J^{*\prime}(a) &= -\frac{G'(J^*)}{aG''(J^*)} \\ &> 0. \end{aligned}$$

Note that the monitor's gain and effort are maximized when it holds 100% of the shares; it is assumed here (as in Shleifer and Vishny (1986)) that the legal or other constraints mentioned in the preceding paragraph keep his optimal shareholdings less than 50%.

If the monitor is successful in increasing the present value of the future operating cash flows, the other shareholders share in this gain in firm value, without having incurred any costs. Since the expected gain is an increasing function of the monitor's effort and the optimal effort is in turn an increasing function of the proportion of the shares held by the monitor, firm value is an increasing function of the proportion. The other shareholders might be willing to incur some costs if this would encourage the monitor to increase its efforts.

If the monitor is another individual shareholder, it is not clear what the individual shareholders could do. However the level of expertise and financial resources required to obtain a significant stake in public corporations and to evaluate their management practices suggests that the monitor might be another corporation.[26]

In terms of the distinction between operating and investing activities made earlier, the monitor's operations involve evaluating other corporation's management, determining if an improvement can be made, and realizing a gain if the improvement is made. Once having realized the gain, the monitor would continue to hold the shares of the corporation only as part of its investment business. As before, in its operating activity as a monitor, its expected average return exceeds its expected marginal return; but in its investment activities its expected average return equals its expected marginal return. Since then the monitor would hold the shares only long enough

[26] Of the 354 firms in Shleifer and Vishny's sample (p. 462) with significant minority shareholders, 117 of the minority shareholders were financial firms. Some of the other categories they mention may also have been corporations, but it is impossible to determine based on their description.

to realize the increase in share price, it would prefer to receive dividends more than capital gains.[27]

The monitor's optimal level of effort is therefore an increasing function of the expected present value of dividends $D_{PV} = E\{\sum_{j=t+1}^{\infty} r^{t-j} D_j\}$.[28] Assuming the tax rate T is intertemporally constant, firm value is maximized[29] when the expected present value of dividends satisfies:

$$G' J^{*\prime}(D_{PV}) \;=\; T \qquad (1.7)$$

unless a corner solution ($D_{PV} = 0$) is optimal. In a neighborhood of the optimal level of dividends, firm value is approximately a quadratic function of dividends, with the coefficient on dividends being positive and that on dividends squared being negative.[30]

Although the equation indicates the optimal level of the expected present value of future dividends, it does not indicate how this level should be distributed through

[27] Assuming as above and as in Shleifer and Vishny (1986) that its tax rate on dividends is less than its effective tax rate on capital gains and that it prefers to use most of its assets to identify and invest in firms where an improvement in management could be made.

[28] It is not clear that r is the appropriate discount rate here. However, the results that follow depend only on there being some appropriate discount rate.

[29] Firm value equals nonoperating assets plus the expected value of operating cash flows in the absence of a monitor plus the increase in the expected value of the operating cash flows as a result of the monitor's effort less the tax cost: $V_t = constant + G(J) - TD_{PV}$. Since the optimal level of the monitor's effort is a function of the expected present value of dividends, shareholders will maximize the equation with respect to D_{PV}.

[30] This is just a restatement of the standard first and second order conditions for a local maximum. Using a Taylor's series expansion, firm value can be expressed as a function of dividends:

$$V = d_0 + d_1 D + d_2 D^2 + \text{higher order terms.}$$

The second order condition requires that

$$d_2 < 0$$

and the first order condition requires that

$$d_1 + 2d_2 D = 0$$

so that $d_1 > 0$.

time, nor does it indicate how shareholders would determine G and J^*. Yet, if the monitor is going to dispose of its interest shortly after its improvement is implemented, and if shareholders cannot determine ex ante when a monitor will identify an improvement, then the monitor will want to know the distribution of dividends through time. Since nonoperating assets may be any amount and do not relate to current monitoring efforts, it seems unlikely that there would be a relation between optimum dividends and nonoperating assets. Since dividends determine firm value, setting optimum dividends as a function of firm value would be circular. A persistent increase in operating cash flow is desirable to shareholders and is presumably what an improvement proposed by the monitor should produce. Letting v_t represent the part of operating cash flow that will not persist, it then seems reasonable to conclude that optimal dividends will be a function of persistent operating cash flow:[31]

$$D_t = \delta(Y_t - v_t).$$

Note that the function δ is assumed to be intertemporally constant. In the rest of the paper it is assumed to be linear.[32] In a neighborhood of the optimal level of the dividend payout rate d, firm value is approximately a quadratic function of the payout rate with the coefficient on d being positive and the coefficient on d^2 being negative.

[31] As noted earlier, the managers interviewed by Lintner (1956) and Baker et al. (1985) stated that they would change dividends only in the face of a persistent change in earnings or cash flows.

[32] The following reasoning supports this assumption. The function δ can be expressed as a Taylor series expansion as follows:

$$D_t = d_0 + d_1[Y_t - v_t] + d_2[Y_t - v_t]^2 + \ldots\ldots$$

Legal constraints prevent the firm from consistently paying out more than its income, which would indicate that d_0, d_2, d_3, ... must be nonpositive. However, substituting this representation of the optimal dividend into equation 1.7 indicates that any nonzero terms must be equal and positive. Thus d_1 must be positive (and less than 1) and all other terms must be zero:

$$D_t = d_1[Y_t - v_t].$$

In the remainder of this paper d_1 will be called simply d.

1.3.6 Expectations

To relate firm value to observable variables rather than to expectations of future cash flows and dividends, additional assumptions are required. Assume that expected operating cash flow grows at a rate $g < r$, i.e.

$$E_t\{Y_{t+j+1}\} = gE_t\{Y_{t+j}\}, \forall j > 0.$$

$g > 1$ implies that operating cash flow is expected to increase each period, $g = 1$ implies that operating cash flow is expected to be intertemporally constant, and $g < 1$ implies that operating cash flow is expected to decrease each period. The growth rate is required to be less than the discount rate in order to keep the present value of expected future operating cash flows finite.

From equation 1.4, firm value at the end of a period equals nonoperating assets at the end of the period plus a multiple of the following period's expected operating cash flow less the expected present value of the tax cost of future dividends:

$$\begin{aligned} V_t &= C_t + E_t\{\sum_{j=t+1}^{\infty} r^{t-j} g^{j-1-t} Y_{t+1}\} - E_t\{\sum_{j=t+1}^{\infty} r^{t-j} D_j T_j\} \\ &= C_t + E_t\{\frac{Y_{t+1}}{[r-g]}\} - E_t\{\sum_{j=t+1}^{\infty} r^{t-j} D_j T_j\} \end{aligned}$$

Section 1.3.5 argued that dividends are proportional to persistent operating cash flow:

$$D_t = d[Y_t - v_t].$$

Moving one period forward and taking expectations shows expected dividends to be proportional to expected operating cash flow:

$$\begin{aligned} E_t\{D_{t+1}\} &= dE_t\{[Y_{t+1} - v_{t+1}]\} \\ &= dE_t\{Y_{t+1}\}. \end{aligned}$$

Assuming constant tax rates, the expected dividend tax cost is proportional to the expected value of next period's operating cash flow:

$$E_t\{\sum_{j=t+1}^{\infty} r^{t-j} D_j T_j\} = T_t E_t\{\sum_{j=t+1}^{\infty} r^{t-j} D_j\}$$

$$
\begin{aligned}
&= dT_tE_t\{\sum_{j=t+1}^{\infty} r^{t-j}Y_j\} \\
&= dT_tE_t\{\sum_{j=t+1}^{\infty} r^{t-j}g^{j-t-1}Y_{t+1}\} \\
&= dT_tE_t\{\frac{Y_{t+1}}{[r-g]}\}.
\end{aligned}
$$

Firm value equals the nonoperating assets plus a term proportional to persistent operating cash flow:

$$
\begin{aligned}
V_t &= C_t + E_t\{\frac{Y_{t+1}}{[r-g]}\} - dT_tE_t\{\frac{Y_{t+1}}{[r-g]}\} \\
&= C_t + E_t\{Y_{t+1}\frac{[1-dT_t]}{[r-g]}\} \\
&= C_t + [Y_t - v_t]\frac{g[1-dT_t]}{[r-g]}. \qquad (1.8)
\end{aligned}
$$

Using the definition of the dividend payout rate shows firm value to also equal nonoperating assets plus a term proportional to dividends:

$$
V_t = C_t + D_t\frac{[gd^{-1} - gT_t]}{[r-g]}. \qquad (1.9)
$$

Note that persistent operating cash flow $Y_t - v_t$ in equation 1.8 is not easily available to the market, since it requires identifying the transitory component of operating cash flow. Firm value in equation 1.9 implicitly assumes that the market accepts that management can accurately identify the transitory component. Given this assumption, the equation states that the only accounting information needed to supplement current dividends in determining firm value is the stock of nonoperating assets. Dividends are a sufficient statistic for the expected future performance of the firm; nonoperating assets are sufficient for past performance.[33]

[33] If the production function does not vary through time, then $g = 1$ and operating cash flow equals operating earnings. Although in the presence of growth, operating earnings may differ from operating cash flow by the change in operating assets, operating earnings may represent more reliable information than operating cash flow since it is easier to verify ex post which assets are operating and which are nonoperating than it is ex ante.

1.3.7 Change in firm value is a function of change in dividends

The preceding subsection assumed that operating cash flow is expected to grow at rate g, and that any difference between the actual cash flow and the expected cash flow was completely transitory. An alternate assumption is that cash flow follows a random walk, i.e. that any shock is completely persistent. To allow for both possibilities, assume that there are two shocks each period, one persistent labeled u, the other transitory labeled v. Operating cash flow then is assumed to evolve over time as:

$$Y_t = g[Y_{t-1} - v_{t-1}] + u_t + v_t, \quad \text{where}$$
$$E\{u_t\} = 0 = E\{v_t\}.$$

That is, operating cash flow is last period's persistent operating cash flow (i.e., its cash flow other than the transitory component) times the growth rate, plus two stochastic shocks, one of which is persistent and one transitory.

Operating cash flow next period is:

$$\begin{aligned} Y_{t+1} &= g[Y_t - v_t] + u_{t+1} + v_{t+1} \\ &= g^2[Y_{t-1} - v_{t-1}] + gu_t + u_{t+1} + v_{t+1}. \end{aligned}$$

Its current expected value is the current period's persistent operating cash flow times the growth rate, or equivalently last period's operating cash flow multiplied by the growth rate twice, plus this period's persistent shock times the growth rate:

$$\begin{aligned} E_t\{Y_{t+1}\} &= g[Y_t - v_t] \\ &= g^2[Y_{t-1} - v_{t-1}] + gu_t. \end{aligned}$$

Its expected value last period is simply last period's operating cash flow multiplied by the growth rate squared:

$$E_{t-1}\{Y_{t+1}\} = g^2[Y_{t-1} - v_{t-1}].$$

Using these relations and equation 1.8 and assuming a constant tax rate shows that the cum dividend change in firm value equals nonoperating income plus operating cash flow plus a term proportional to the change in persistent operating cash flows:

$$\begin{aligned}
V_t &= C_t + [Y_t - v_t]\frac{g[1-dT]}{[r-g]} && (1.8)\\
V_{t+1} &= r'_{t+1}C_t + Y_{t+1} - D_{t+1} + [Y_{t+1} - v_{t+1}]\frac{g[1-dT]}{[r-g]}\\
V_{t+1} + D_{t+1} - V_t &= [r'_{t+1} - 1]C_t + Y_{t+1} + [\{Y_{t+1} - v_{t+1}\} - \{Y_t - v_t\}]\frac{g[1-dT]}{[r-g]}\\
&= [r'_{t+1} - 1]C_t + Y_{t+1} + [\{Y_t - v_t\}\{g-1\} + u_{t+1}]\frac{g[1-dT]}{[r-g]}.
\end{aligned}$$

where r' is the realized return on the nonoperating (financial) assets ($E\{r'\} = r$). Alternately using equation 1.9 shows that the cum dividend change in firm value equals nonoperating income plus operating cash flows plus a term proportional to the change in dividends:

$$\begin{aligned}
V_t &= C_t + D_t\frac{[gd^{-1} - gT]}{[r-g]} && (1.9)\\
V_{t+1} &= C_{t+1} + D_{t+1}\frac{[gd^{-1} - gT]}{[r-g]}\\
V_{t+1} &= r'_{t+1}C_t + Y_{t+1} - D_{t+1} + D_{t+1}\frac{[gd^{-1} - gT]}{[r-g]}\\
V_{t+1} + D_{t+1} - V_t &= [r'_{t+1} - 1]C_t + Y_{t+1} + [D_{t+1} - D_t]\frac{[gd^{-1} - gT]}{[r-g]} && (1.10)
\end{aligned}$$

1.3.8 Variation in the dividend response coefficient

The dividend response coefficient in equation 1.10 for the effect on change in firm value of a change in the change in dividends is the same as the dividend response coefficient in equation 1.9 for the effect on firm value of a change in dividends, assuming no change in tax rates:

$$DRC = \frac{gd^{-1} - gT}{r-g}. \qquad (1.11)$$

The dividend response coefficient is a function of the payout rate, the growth rate, the effective tax rate, and the discount rate. The rates may vary through time and among firms; the effect of a rate variation on the DRC can be determined by differentiating the equation with respect to that rate.

The effect on the dividend response coefficient of a change in the dividend payout rate is:

$$\frac{\partial DRC}{\partial d} = \frac{-gd^{-2}}{r-g}$$

which is negative[34]. The larger the payout rate the lower is the expected increase in each future period's operating cash flows indicated by a given increase in current dividends.

The effect on the dividend response coefficient of a change in the discount rate is:

$$\frac{\partial DRC}{\partial r} = \frac{gT - gd^{-1}}{[r-g]^2}$$

which is negative[35]. The larger the discount rate, the lower the present value of the indicated increase in future operating cash flows, and so the smaller the increase in firm value.

The effect on the dividend response coefficient of a change in the effective tax rate on dividends is:

$$\frac{\partial DRC}{\partial T} = \frac{-g}{r-g}$$

which is negative. The higher the tax rate, the higher is the tax cost of the dividend, which dampens the increase in firm value arising from the increase in dividends.

The effect on the dividend response coefficient of a change in the growth rate is:

$$\frac{\partial DRC}{\partial g} = \frac{rd^{-1} - rT}{[r-g]^2}$$

which is positive. The higher the growth rate, the greater is the effect on future operating cash flows of the increase in this period's persistent operating cash flows indicated by the dividend increase, and so the greater is the increase in firm value.

---

[34] Recall that the growth rate g is assumed to be less than the discount rate r.

[35] The dividend payout rate d and the effective tax rate on dividends T are both assumed to be between zero and one, so that d^{-1} is greater than one and so greater than T.

1.3.9 Discussion

Using standard financial economic assumptions, a model of firm value as the present value of expected future cash flows has been developed. Distinguishing between operating assets (real inputs) and nonoperating assets (financial inputs) and recognizing the tax cost of dividends in comparison to unrealized capital gains, firm value was shown to be the present value of expected future cash flows to the firm from nonoperating activities, plus expected future cash flows to the firm from operating activities, *minus* expected future cash flows from the firm to investors in the form of dividends times the effective tax rate on dividends. The present value of expected future cash flows from nonoperating activities equals the current value of the nonoperating assets.

Assuming dividends are related to expected future operating cash flows in an optimal manner implies that firm value could also be viewed as a concave function of the dividend payout rate. Assuming that operating cash flows are expected to grow at a constant rate permitted replacing the expectations with currently observable variables so that firm value was shown to equal nonoperating assets plus a term proportional to current dividends.

The model proposed that dividends proxy for persistent operating cash flow. The Miller and Rock model proposed that dividends equal operating cash flow and that, when management has information about the production function not available to shareholders, dividend announcements convey this information, but at a cost of *less than optimal* input to the production function. The model developed in this section recognized that dividend distribution imposes a cost due to provisions in the tax code, but that using dividends as an incentive to monitors results in a *more optimal* selection of inputs.

Equation 1.10 implies that the change in firm value equals nonoperating income plus operating cash flow plus a term proportional to the change in dividends. Nonoperating income plus operating cash flow differs from earnings by the difference in operating assets between the end of the previous period and the end of the current period. When the production function and the discount rate do not change through time, this difference is nil. Nevertheless, it would appear that cash flow would be at least as useful information as earnings; yet accounting earnings receive timely and significant coverage by the financial press, while cash flows are often ignored. One possible explanation for this anomaly is the difficulty of timely independent verification of cash flow reports, since the distinction between operating and nonoperating assets is more difficult to verify at the beginning of the period than at the end. More importantly, selecting less than optimal inputs to next period's production function would increase this period's cash flow. The increase in reported cash flow would cause an increase in firm value which would benefit shareholders disposing of their shares and penalize those purchasing shares. The selection of suboptimal inputs would also penalize current shareholders who did not sell their shares, since next period's cash flow would be less than optimum. Thus if cash flow were a widely reported accounting number, it would suffer from the same problems as do dividends in Miller and Rock's (1985) model. Since earnings do not suffer from these problems, it is not surprising that they are the commonly reported performance indicator.

1.4 Announcement date earnings and dividend response coefficients

The previous section developed a model in which firm value V equals the firm's nonoperating assets C plus a term proportional to its current dividend D. The model assumed that the operating cash flow Y of the firm is expected to grow at a constant rate g:[36]

$$Y_{t+1} = g[Y_t - v_t] + u_{t+1} + v_{t+1}$$

where u and v are stochastic shocks with mean zero, the former being persistent and the latter being transitory. The model assumed that the increase in nonoperating assets equals the cash flows from operating and nonoperating activities less the dividend paid:

$$C_{t+1} = C_t + [r'_{t+1} - 1]C_t + Y_{t+1} - D_{t+1}.$$

The model also assumed that dividends are declared and paid at the end of each period in an amount equal to a constant payout rate d times persistent operating cash flow

---

[36] Some models assume that firms experience significant growth (possibly at a rate in excess of their discount rate) only in the early stages of their existence. After a finite number of periods, their production technology stabilizes and remains the same for the rest of their existence. Such an assumption might also imply that the firm's discount rate should be different in the two stages, since it seems possible that the period of growth might be a more risky period than the ensuing period of stability. The effect of this alternate assumption on the results of the model has not been explored.

$Y_t - v_t$,[37] that the shareholders discount expected future operating cash flows at a constant rate r, and that the effective dividend tax rate paid by the shareholders is T. As derived in equation 1.9, these four rates determine the dividend response coefficient:

$$V_t = C_t + D_t \frac{[gd^{-1} - gT_t]}{[r-g]}. \qquad (1.9)$$

This section examines the effect of the timing of earnings and dividend announcements on firm value. Since both announcements potentially provide some information on current and future operating cash flows, both announcements could affect firm value. However, the second announcement will generally provide less information than the first, and therefore should have a smaller effect. The section first examines the effect of the order in which the earnings and dividend announcements are made on the earnings and dividend response coefficients, and second determines the effect on these response coefficients of changes in the dividend payout rate, the discount rate, the effective tax rate on dividends, and the growth rate.

Denote by 1.0 the time a selected period starts. Let 2.0 denote the end of the period, 2.1 denote the time of the first announcement, and 2.2 denote the time of the second announcement. Let $E_{2.0}$ denote the expectations operator based on the information available at the end of the period before either announcement occurs; $E_{2.1}$ denote the expectations operator based on the information after the first announcement but before the second announcement; and $E_{2.2}$ denote the expectations operator based on the information after both announcements have been made. At time 2.0 before the announcements, firm value from the above equation suppressing the subscript on taxes is:

$$\begin{aligned} V_t &= C_t + D_t \frac{[gd^{-1} - gT]}{[r-g]} \qquad (1.9) \\ V_{2.0} &= E_{2.0}\{C_2\} + E_{2.0}\{D_2 \frac{[gd^{-1} - gT]}{[r-g]}\} \end{aligned}$$

where the expectations operator has been added since neither dividends nor earnings have been announced. In particular, dividends have not been paid, so that firm value

[37] This implies that dividends are expected to grow at the same rate g as operating cash flow.

is cum dividend, nonoperating assets do not need to be adjusted for the expected dividend, but firm value does need to be adjusted for the expected dividend tax cost. The equation can be rewritten showing firm value to equal expected nonoperating income plus expected operating cash flow plus a term proportional to expected dividends:

$$\begin{aligned} V_{2.0} &= E_{2.0}\{C_2\} + E_{2.0}\{D_2 \frac{[gd^{-1} - gT]}{[r-g]}\} \\ &= rC_1 + E_{2.0}\{Y_2\} + E_{2.0}\{D_2[\frac{[gd^{-1} - gT]}{[r-g]} - T]\} \\ &= rC_1 + E_{2.0}\{Y_2\} + E_{2.0}\{D_2 \frac{[gd^{-1} - gT - rT + gT]}{[r-g]}\} \\ &= rC_1 + E_{2.0}\{Y_2\} + E_{2.0}\{D_2 \frac{[gd^{-1} - rT]}{[r-g]}\}. \end{aligned} \tag{1.12}$$

The effect of both announcements on firm value equals unexpected nonoperating income and operating cash flow $UE_2 = \{E_{2.2} - E_{2.0}\}\{[r' - 1]C_1 + Y_2\}$ plus a term proportional to unexpected dividends $UD_2 = \{E_{2.2} - E_{2.0}\}\{D_2\}$:[38]

$$\begin{aligned} V_{2.2} - V_{2.0} &= \{E_{2.2} - E_{2.0}\}\{r'C_1 + Y_2 + D_2 \frac{[gd^{-1} - rT]}{[r-g]}\} \\ &= UE_2 + UD_2 \frac{[gd^{-1} - rT]}{[r-g]}. \end{aligned} \tag{1.13}$$

The change in firm value can also be expressed as the nonoperating income shock $[r' - r]C_1$, which is transitory, the transitory operating shock plus a term proportional to the persistent operating shock:

$$\begin{aligned} V_{2.2} - V_{2.0} &= \{E_{2.2} - E_{2.0}\}\{r'C_1 + Y_2 + D_2 \frac{[gd^{-1} - rT]}{[r-g]}\} \\ &= \{E_{2.2} - E_{2.0}\}\{r'C_1 + g[Y_1 - v_1] + u_2 + v_2 + d[Y_2 - v_2] \frac{[gd^{-1} - rT]}{[r-g]}\} \\ &= \{E_{2.2} - E_{2.0}\}\{r'C_1 + u_2 + v_2 + du_2 \frac{[gd^{-1} - rT]}{[r-g]}\} \end{aligned}$$

[38] Some firms do not pay dividends. In the model developed in this paper, this can occur for two reasons. Dividends are proportional to persistent operating cash flow, but are constrained to be positive (or zero). If persistent operating cash flow is negative (or zero) then no dividends will be paid. The dividend payout rate d is determined by trading off the gains from monitoring and the effective tax cost on the dividends to be paid. In some cases, it may be that the optimum trade-off is to set the payout rate to zero, so that no dividends are paid.

$$
\begin{aligned}
&= [r'-r]C_1 + u_2 + v_2 + du_2\frac{[gd^{-1}-rT]}{[r-g]} \\
&= [r'-r]C_1 + v_2 + u_2\frac{[r-g+g-drT]}{[r-g]} \\
&= [r'-r]C_1 + v_2 + u_2\frac{[r-drT]}{[r-g]}.
\end{aligned}
$$

The equation gives the effect of both announcements; the following subsections analyze the effects of each announcement. Note that in each case, the sum of the first and the second announcements equals the amount given in the equation.

1.4.1 Earnings announced first

When earnings are announced first, the market can update its estimates of the components of equation 1.12. Operating cash flow can be expressed in terms of past operating cash flow or operating earnings adjusted for the change in operating assets:

$$
\begin{aligned}
Y_2 &= g[Y_1 - v_1] + u_2 + v_2 \\
&= X_2 - I_2 + I_1 - [r'-1]C_1.
\end{aligned}
$$

The change in expectations of operating cash flow is related to the change in expectations of the stochastic shocks and to unexpected earnings:[39]

$$
\begin{aligned}
\{E_{2.1} - E_{2.0}\}\{Y_2\} &= \{E_{2.1} - E_{2.0}\}\{u_2 + v_2\} \\
&= \{E_{2.1} - E_{2.0}\}\{X_2 - I_2 - [r'-1]C_1\} \\
&= \{E_{2.1} - E_{2.0}\}\{X_2\} - \{E_{2.1} - E_{2.0}\}\{I_2\} \\
&- \{E_{2.1} - E_{2.0}\}\{[r'-1]C_1\}.
\end{aligned}
$$

Positive unexpected earnings may be due to a positive persistent shock or a positive transitory shock.[40] A positive transitory shock[41] is not associated with a change

[39] Recall that the discount rate r is assumed to be known and intertemporally constant.

[40] An unexpected increase in the input to next period's production function would produce a negative unexpected operating cash flow but would not affect current period earnings.

[41] As defined in this paper

in next period's production function or next period's input.[42] A positive persistent shock is associated with a change in next period's production function since it implies that next period's cash flow will be higher than previously expected which implies that input will be lower or output higher. The revision in the expectation of the input, I_2, to next period's production function caused by the earnings announcement is therefore likely to be small. A more realistic model (with other sources of information about the firm) might posit revisions to the expectations of next period's input from one of these other sources. The balance of this paper assumes that these revisions are zero. Thus, *UE* denotes both unexpected earnings and unexpected nonoperating income plus operating cash flow:

$$\begin{aligned} UE_{2.1} &= X_2 - E_{2.0}\{X_2\} \\ &= \{E_{2.1} - E_{2.0}\}\{[r' - 1]C_1 + Y_2\} \\ &= \{E_{2.1} - E_{2.0}\}\{[r' - 1]C_1 + u_2 + v_2\}. \end{aligned}$$

It also seems reasonable to assume that the expected value of the transitory and the persistent stochastic term, given unexpected earnings, would be a fraction of unexpected earnings, that is:[43]

$$0 \ < \ \frac{E_{2.1}\{u_2\}}{UE_{2.1}} < 1$$

and

$$0 \ < \ \frac{E_{2.1}\{v_2\}}{UE_{2.1}} < 1.$$

The earnings announcement causes a revision in the expected dividend in the same direction as the expected persistent component of unexpected earnings. Recalling that dividends reflect management's expectations of persistent operating cash flow,

---

[42] It does affect next period's earnings and nonoperating income since it increases nonoperating assets.

[43] This assumption is not necessary to derive the succeeding mathematical relations. The verbal interpretations of the mathematical results does sometimes depend on this assumption. In particular it is generally supposed that if the sum of the shocks is positive, then the persistent shock itself is positive.

the expected dividends are revised in proportion to the expected persistent shock:

$$\begin{aligned}\{E_{2.1} - E_{2.0}\}\{D_2\} &= d\{E_{2.1} - E_{2.0}\}\{Y_2 - v_2\} \\ &= d\{E_{2.1} - E_{2.0}\}\{u_2\}.\end{aligned}$$

Thus the change in firm value at the earnings announcement date equals unexpected earnings plus a term proportional to the revision in the expected dividends or the expected persistent shock. From equation 1.12:

$$\begin{aligned}V_{2.1} - V_{2.0} &= UE_{2.1} + \{E_{2.1} - E_{2.0}\}\{D_2\}\frac{[gd^{-1} - rT]}{[r-g]} \\ &= UE_{2.1} + E_{2.1}\{u_2\}\frac{[g - drT]}{[r-g]}. \qquad (1.14)\end{aligned}$$

1.4.2 Dividends announced second

When dividends are subsequently announced, the market can compute management's belief as to the persistence of the earnings change:

$$\begin{aligned}D_2 &= d[Y_2 - v_2] \\ &= d[g(Y_1 - v_1) + u_2].\end{aligned}$$

Unexpected dividends are:

$$\begin{aligned}UD_{2.2} &= D_2 - E_{2.1}\{D_2\} \\ &= \{1 - E_{2.1}\}\{d[g(Y_1 - v_1) + u_2]\} \\ &= d[u_2 - E_{2.1}\{u_2\}].\end{aligned}$$

From equation 1.12 the change in firm value is proportional to the unexpected dividends:

$$\begin{aligned}V_{2.2} - V_{2.1} &= \{E_{2.2} - E_{2.1}\}\{[r' - 1]C_1 + Y_2 + D_2\frac{[gd^{-1} - rT]}{[r-g]}\} \\ &= \{E_{2.2} - E_{2.1}\}\{[r' - 1]C_1 + X_2 - I_2 + I_1 + D_2\frac{[gd^{-1} - rT]}{[r-g]}\} \\ &= \{E_{2.2} - E_{2.1}\}\{D_2\frac{[gd^{-1} - rT]}{[r-g]}\} \\ &= UD_{2.2}\frac{[gd^{-1} - rT]}{[r-g]}. \qquad (1.15)\end{aligned}$$

1.4.3 Dividends announced first

Suppose instead that dividends were announced first. As noted above, in this case the market can determine the persistent component of the earnings shock u_2, but not the transitory component v_2 or the total shock $u_2 + v_2$. Unexpected dividends are proportional to the persistent shock and equal to the announced dividend less the expected dividend:[44]

$$\begin{aligned}
UD_{2.1} &= D_2 - E_{2.0}\{D_2\} \\
&= \{1 - E_{2.0}\}\{d[g(Y_1 - v_1) + u_2]\} \\
&= du_2 \\
&= D_2 - dg[Y_1 - v_1] \\
&= D_2 - gD_1.
\end{aligned}$$

The dividend announcement causes a revision in expected operating cash flow proportional to unexpected dividends:

$$\begin{aligned}
\{E_{2.1} - E_{2.0}\}\{Y_2\} &= \{E_{2.1} - E_{2.0}\}\{g[Y_1 - v_1] + u_2 + v_2\} \\
&= \{E_{2.1} - E_{2.0}\}\{u_2\} \\
&= u_2 \\
&= UD_{2.1}/d.
\end{aligned}$$

Thus the change in firm value at the dividend announcement date is proportional to unexpected dividends or the persistent shock. From equation 1.12:

$$\begin{aligned}
V_{2.1} - V_{2.0} &= \{E_{2.1} - E_{2.0}\}\{r'C_1 + Y_2\} + \{E_{2.1} - E_{2.0}\}\{D_2\}\frac{[gd^{-1} - rT]}{[r - g]} \\
&= UD_{2.1}\frac{[rd^{-1} - gd^{-1} + gd^{-1} - rT]}{[r - g]} \\
&= UD_{2.1}\frac{[rd^{-1} - rT]}{[r - g]} \\
&= u_2\frac{[r - drT]}{[r - g]}. \qquad (1.16)
\end{aligned}$$

[44] Recall that dividends are expected to grow at rate g.

1.4.4 Earnings announced second

When earnings are subsequently announced, the market can determine the transitory earnings shock $[r' - r]C_1 + v_2$, and firm value will change by the amount of the unexpected earnings, given the announced dividends:

$$V_{2.2} - V_{2.1} = UE_{2.2} = [r' - r]C_1 + v_2. \tag{1.17}$$

1.4.5 Numerical example

Table 1.10 replicates table 1.7 in providing a numerical example of the theoretical model. In this table all shocks (the persistent operating shock u, the transitory operating shock v, and the transitory nonoperating shock $[r' - r]$) are assumed to be zero. Recall that operating assets are determined by maximizing firm value. Each period the firm therefore maximizes:

$$f_{t+1}(I_t) - rI_t$$

Firm value is given by equations 1.9 or 1.4:

$$V_t \;=\; C_t + E_t\{\sum_{j=t+1}^{\infty} r^{t-j}Y_j\} - E_t\{\sum_{j=t+1}^{\infty} r^{t-j}D_jT_j\}$$

Since there are no shocks, unexpected dividends and unexpected earnings are zero. Therefore no market reaction occurs with either announcement.

Table 1.11 provides an example of the effect of operating transitory shocks in periods 2 and 4. The one dollar transitory shock in period 2 increases operating cash flow, operating income, net income, nonoperating assets, equity, firm value, and return by one dollar in period 2 compared to the case where there were no shocks shown in table 1.10. It increases period 3 investment income, net income, and return by ten cents, being the one dollar shock times the 10% discount rate. It has no effect on dividends since it is not persistent.

If dividends are announced first in period 2, then the announcement will be for dividends to increase by the growth rate of 7%, so that unexpected dividends will be zero. Net income has increased by one dollar, so that unexpected earnings equals the increase in returns and firm value of one dollar.

If earnings are announced first in period 2, the market must guess how much of the unexpected one dollar is persistent and how much is transitory. In the table, it is assumed that the market guesses that 50 cents is persistent and 50 cents is transitory. This causes the firm value to jump by \$17.73.[45] When the dividends are subsequently announced, the market can determine that the entire one dollar of unexpected earnings was transitory. Before either announcement, period two dividends were expected to grow by $g = 1.07$ from period one dividends to a value of $\$1.07 * 2.20 = \$2.35$. After earnings were announced, the market guessed that the persistent shock was 50 cents, so that period two dividends were expected to be $\$0.50 * 0.20 = \$0.10$ higher, i.e. \$2.45. When dividends are announced as \$2.35, the dividend surprise is $-\$0.10$. Firm value will decline by \$16.73,[46] so that the effect of the two announcements is to increase firm value by one dollar over what it would otherwise have been. Note that firm value at the end of period 2 is \$426.80 in table 1.11 compared to \$425.80 in table 1.10.

The period 4 transitory shock has the opposite effect. The particular shock shown in the table[47] has the effect of making firm value in period 4 and all the amounts in period 5 the same as if there had been no shocks, which can be seen be comparing the entries in tables 1.11 and 1.10.

Table 1.12 provides an example of persistent shocks in periods 2 and 4. The one

[45] Recall from equation 1.14 that the change in firm value is

$$UE_{2.1} + E_{2.1}\{u_2\}\frac{[g - drT]}{[r - g]}.$$

$$= 1.00 + .50\frac{[1.07 - 0.20 * 1.10 * 0.30]}{[1.10 - 1.07]}.$$

[46] Recall from equation 1.15 that the change in firm value is

$$UD_{2.2}\frac{[gd^{-1} - rT]}{[r - g]}.$$

$$= -.10\frac{[1.07/0.20 - 1.10 * 0.30]}{[1.10 - 1.07]}.$$

[47] It was calculated as the period 2 shock times the discount rate squared.

dollar persistent shock in period 2 increases period 2 operating cash flow, operating income, and net income by one dollar compared to that shown in table 1.10. It increases period 2 dividends by 20 cents, being the persistent shock times the 20% payout rate. It increases period 3 operating cash flow by $1.07 being the one dollar persistent shock times the 7% growth rate. It increases period 3 investment income by eight cents, being the one dollar shock less the extra 20 cent dividend paid out times the 10% discount rate. If dividends are announced first, then the twenty cents of unexpected dividends identifies a one dollar persistent increase in operating cash flow, which causes firm value to jump by $34.47. The subsequent earnings announcement contains no surprise and so firm value does not change.

If earnings are announced first, the market must determine how much of the one dollar surprise is persistent. As before, the table assumes that the market guesses that fifty cents is persistent. This produces a jump of $17.73 in firm value. When dividends are subsequently announced, the market can determine that the entire earnings surprise was persistent, so that firm value jumps by a further $16.73.

The period 4 persistent shock has the opposite effect. The particular shock shown in the table[48] has the effect of making the value of the operating business in period 4 and all the amounts relating to the operating business in period 5 the same as if there had been no shocks, which can be seen be comparing the entries in tables 1.12 and 1.10.

Table 1.13 shows the effect of transitory and persistent shocks occurring in the same period. The one dollar shock in period 2 is half transitory and half persistent. The effect on the financial statement amounts and firm value is midway between the effects shown in the previous two tables. Note that when earnings are announced first, the market's guess that half the earnings surprise is transitory and half is persistent is correct, so that there is no unexpected component to the subsequent dividend announcement. Of course, if the proportion of transitory and persistent shocks differed from the market's belief, then both announcements would have surprises and cause revisions in firm value.

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[48] It was calculated as the period 2 shock times the growth rate squared.

1.4.6 Variation in the dividend and earnings response coefficients

The dividend and earnings response coefficients are summarized in the first row of table 1.14. There are two dividends response coefficients. The first is derived from equation 1.16 and shows the response of firm value to the dividend announcement when it precedes the earnings announcement. The second is derived from equations 1.12, 1.13, and 1.15 and shows the effect on the response of firm value to the dividend announcement over the entire announcement period or at the date of the dividend announcement when that occurs after the earnings announcement. The dividend response coefficient when dividends are announced first is larger than the dividend response coefficients when dividends are announced second since the discount rate r is larger than the growth rate g. When dividends are announced first, the announcement provides information about both current persistent and future operating cash flows; when dividends are announced after earnings, the announcement provides information about future operating cash flows only, since the preceding earnings announcement has already provided information about current operating cash flows. Thus the dividend response coefficient when dividends are announced first is larger than the dividend response coefficient when dividends are announced second by the inverse of the dividend payout rate.

When earnings are announced first, the effect of the earnings surprise on firm value is given by equation 1.14. Let γ denote the proportion of the earnings surprise that is expected to be persistent:

$$\gamma = \frac{E_{2.1}\{u_2\}}{UE_{2.1}}.$$

Equation 1.14 can be written as:

$$V_{2.1} - V_{2.0} = UE_{2.1}\{1 + \gamma\frac{[g - drT]}{[r - g]}\}. \tag{1.18}$$

Assuming γ is positive, that is that the sign of the persistent shock is the same as the sign of the sum of the persistent shock and the transitory shock, then the earnings response coefficient when earnings are announced first is greater than one and thus is greater than the earnings response coefficient when earnings are announced second.

The response coefficients are functions of the dividend payout rate, the discount rate, the tax rate, and the growth rate. The magnitude and sign of the effect of changes in these rates on the response coefficients can be derived by differentiating the expressions for them in the first row of the table. The results of this exercise are given in table 1.14.

Qualitatively, the effect of changes in the rates on the two dividend response coefficients is the same. A given increase in future operating cash flows will occasion a larger increase in dividends, the larger is the dividend payout rate. Thus the larger the payout rate, the lower is the expected increase in each future period's operating cash flows indicated by a given increase in current dividends. The higher the growth rate, the greater is the effect on future operating cash flows of the increase in permanent income indicated by the dividend increase, and so the greater is the increase in firm value. The larger the discount rate, the lower the present value of the indicated increase in future operating cash flows, and so the smaller the increase in firm value.

The third column gives the earnings response coefficient for the case when earnings are announced before dividends. It is an increasing function of the persistent proportion γ and the growth rate g, and a decreasing function of the dividend payout rate d, the discount rate r, and the dividend tax rate T.

The higher the persistent proportion of a positive earnings surprise, the higher will be future earnings and so the larger is the increase in firm value.

The higher the growth rate, the greater the increase in future earnings[49] and so the greater the increase in firm value. Higher levels of the dividend payout rate or the dividend tax rate increase the tax cost of dividends and so dampen the increase in firm value. Higher discount rates reduce the present value of the indicated increase in future earnings and so reduce the increase in firm value.

The final column in the table reports that the earnings response coefficient for the case when earnings are announced after dividends is one. Thus changes in any of the four rates have no effect on it.

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[49] This implication and those that follow in the paragraph assume that the persistent proportion γ is positive. In the less likely case that γ is negative, i. e. that the persistent shock has the opposite sign to the transitory shock and is smaller in absolute value than it, these implications would be reversed.

1.4.7 Discussion and summary

Many of the predicted effects of earnings and dividend announcements on firm value have been documented in previous studies. This paper distinguishes itself from previously reported research in having rigorously developed the predictions from a microeconomic model. The model identifies theoretical expressions for the response coefficients, and indicates how they vary depending on the timing of the announcements and cross-sectional and time series changes in the rates. The development of predictions of the variation in the dividend response coefficient due to the order of the announcements and to changes in the four rates has not been documented previously.

As noted in the introduction, the model's prediction that returns at the announcement date and unexpected dividends or earnings should be positively correlated is supported by previous empirical research. No published study has examined the prediction that the second announcement should have less effect on firm value than the first.[50] The model's prediction that the response coefficients should vary depending on the magnitudes of the four rates awaits empirical study, though one previous study did find results similar to the model's predictions in an association setting rather than an announcement setting.

[50] A previous draft of the Brown, Choi, and Kim (1992) working paper did provide empirical support for this prediction.

Table 1.1: Summary of the results of selected previous empirical studies of the relation between firm value and earnings (or cash flow) and dividends

	ERC [1]	*DRC* [2]
Studies that regressed announcement period returns on unexpected earnings and/or dividends		
Aharony and Swary (1980), Table II		+
Aharony and Swary (1980), Table III	+	
Brown, Choi, and Kim (1992), Table 2		+
Divecha and Morse (1983), Table 2		+
Kane, Lee, and Marcus (1984), Table II	+	+
Patell and Wolfson (1984), Table 2	+	
Patell and Wolfson (1984), Table 4		+
Study that regressed annual returns on changes in cash flows and dividends		
Livnat and Zarowin (1990), Table 2	+	+
Studies that regressed firm value on level of earnings and/or dividends		
Easton (1985), Table 2	+	
Easton (1985), Table 3a		+
Easton (1985), Table 3b	+	−
Downes and Heinkel (1982), Table 2	+	−

Notes:

[1] Sign of earnings response coefficient

[2] Sign of dividend response coefficient

Table 1.2: Notation used in development of the theoretical model

C_t	Nonoperating (financial) assets at the end of period t: $[r'_t C_{t-1} + Y_t - D_t]$
d	Dividend payout rate: $[\frac{gD_t}{E_t\{Y_{t+1}\}}]$
D_t	Dividends paid during the period t
DRC	Dividend response coefficient: effect on (change in) firm value of an unexpected change in dividends
ERC	Earnings response coefficient: effect on (change in) firm value of an unexpected change in earnings
E_t	Expected value given the information available at time t
f_t	Production function giving the period t output arising from I_{t-1}
g	Growth rate for operating cash flow ($g = 1$ means no growth)
h_t	"Production" function giving the period t output arising from C_{t-1}
I_t	Operating assets at the end of period t
r	Discount rate (usually > 1)
r'_t	Average return on nonoperating assets: $h_t(C_{t-1})/C_{t-1}$
RE_t	Retained earnings at the end of period t: $[RE_{t-1} + X_t - D_t]$
T_t	Effective tax rate paid by individuals on dividends received during the period t
UD_t	Unexpected dividends for the period t: $[D_t - E_{t-1}\{D_t\}]$
UE_t	Unexpected earnings for the period t: $[X_t - E_{t-1}\{X_t\}]$
u_t	Persistent stochastic shock to the operating cash flow of period t
v_t	Transitory stochastic shock to the operating cash flow of period t
V_t	Firm value at the end of period t
X_t	Earnings for the period t, assuming the operating assets are completely used up: $[[r'_t - 1]C_{t-1} + f_t(I_{t-1}) - I_{t-1}]$
Y_t	Operating cash flow for the period t: $[f_t(I_{t-1}) - I_t]$
γ	Proportion of the earnings surprise that is expected to be persistent: $[\frac{E_{2.1}\{u_2\}}{UE_{2.1}}]$

Table 1.3: Numerical example of the value of an operating business with intertemporally constant production function

Operating revenue	$f_t(I_{t-1})$		20.00
Operating expenditures	I_t		9.00
Operating cash flow	Y_t		11.00
Firm value	V_t		110.00
Assumptions:			
Production function	$f_t(I_{t-1})$	$=$	$-1.75 + 9.90 \log(I_{t-1})$
Opening equity			9.00
Discount rate	r		1.10

Notes:

Operating expenditures are chosen to maximize $f_t(I_{t-1}) - rI_{t-1}$, i.e. $f_t'(I_{t-1}) = r$ which implies, for the production function given above, that $I_{t-1} = 9.90/r = 9.00$.

Operating revenue is $f_t(I_{t-1}) = -1.75 + 9.90 \log(9.00) = 20.00$.

Operating cash flow, which equals operating revenue minus operating expenditures, is $f_t(I_{t-1}) - I_t = 20.00 - 9.00 = 11.00$.

Firm value is $\frac{f_t(I_{t-1}) - I_t}{r-1} = \frac{20.00-9.00}{0.10} = 110.00$.

Table 1.4: Numerical example of an operating business assuming 7% growth rate

Period	t	0	1	2	3	4	5
Operating revenue	$f_t(I_{t-1})$		20.00	21.40	22.90	24.50	26.22
Operating assets	I_t	8.41	9.00	9.63	10.30	11.03	11.80
Operating cash flow	Y_t	-8.41	11.00	11.77	12.60	13.47	14.42
Increase in operating assets	$I_t - I_{t-1}$	8.41	0.59	0.63	0.67	0.73	0.77
Operating income	$f_t(I_{t-1}) - I_{t-1}$	0.00	11.59	12.40	13.27	14.20	15.19
Firm value	V_t	366.67	392.34	419.80	449.18	480.63	514.27
Return	$Y_t + V_t - V_{t-1}$		36.67	39.23	41.98	44.92	48.06
Percentage return	$\frac{Y_t+V_t-V_{t-1}}{V_{t-1}}$		0.100	0.100	0.100	0.100	0.100
Growth in firm value	$\frac{V_t-V_{t-1}}{V_{t-1}}$		0.070	0.070	0.070	0.070	0.070
Assumptions:							
Production function	$f_t(I_{t-1}) =$	$0.30g^t - 8.65(t-1)g^t \log(g) + 8.65g^t \log(I_{t-1})$					
Opening equity		8.41					
Growth rate (operations)	g	1.07					
Discount rate	r	1.10					

Table 1.5: Numerical example of a firm investing in both operating (real) and non-operating (financial) assets

Period	t	0	1	2	3	4	5
Operating revenue	$f_t(I_{t-1})$		20.00	21.40	22.90	24.50	26.22
Operating assets	I_t	8.41	9.00	9.63	10.30	11.03	11.80
Operating cash flow	Y_t	-8.41	11.00	11.77	12.60	13.47	14.42
Increase in operating assets	$I_t - I_{t-1}$	8.41	0.59	0.63	0.67	0.73	0.77
Operating income	$f_t(I_{t-1}) - I_{t-1}$	0.00	11.59	12.40	13.27	14.20	15.19
Investment income	$[r-1]C_{t-1}$		1.00	1.10	1.21	1.33	1.46
Net income	X_t		12.59	13.50	14.48	15.53	16.65
Cash flow distributed	D_t		11.00	11.77	12.60	13.47	14.42
Increase in equity	$X_t - D_t$		1.59	1.73	1.88	2.06	2.23
Nonoperating assets	C_t	10.00	11.00	12.10	13.31	14.64	16.10
Operating assets	I_t	8.41	9.00	9.63	10.30	11.03	11.80
Equity	$C_t + I_t$	18.41	20.00	21.73	23.61	25.67	27.90
Firm value	V_t	376.67	403.34	431.90	462.49	495.27	530.37
Return	$D_t + V_t - V_{t-1}$		37.67	40.33	43.19	46.25	49.52
Percentage return	$\frac{D_t+V_t-V_{t-1}}{V_{t-1}}$		0.100	0.100	0.100	0.100	0.100
Growth in firm value	$\frac{V_t-V_{t-1}}{V_{t-1}}$		0.071	0.071	0.071	0.071	0.071
Assumptions:							
Production function	$f_t(I_{t-1}) =$	$0.30g^t - 8.65(t-1)g^t \log g + 8.65g^t \log I_{t-1}$					
Opening equity		18.41					
Growth rate (operations)	g	1.07					
Discount rate	r	1.10					

Table 1.6: Numerical example assuming a 30% effective tax rate on dividends

Period	t	0	1	2	3	4	5
Operating revenue	$f_t(I_{t-1})$		20.00	21.40	22.90	24.50	26.22
Operating assets	I_t	8.41	9.00	9.63	10.30	11.03	11.80
Operating cash flow	Y_t	-8.41	11.00	11.77	12.60	13.47	14.42
Increase in operating assets	$I_t - I_{t-1}$	8.41	0.59	0.63	0.67	0.73	0.77
Operating income	$f_t(I_{t-1}) - I_{t-1}$	0.00	11.59	12.40	13.27	14.20	15.19
Investment income	$[r-1]C_{t-1}$		1.00	1.10	1.21	1.33	1.46
Net income	X_t		12.59	13.50	14.48	15.53	16.65
Dividends	D_t		11.00	11.77	12.60	13.47	14.42
Increase in equity	$X_t - D_t$		1.59	1.73	1.88	2.06	2.23
Nonoperating assets	C_t	10.00	11.00	12.10	13.31	14.64	16.10
Operating assets	I_t	8.41	9.00	9.63	10.30	11.03	11.80
Equity	$C_t + I_t$	18.41	20.00	21.73	23.61	25.67	27.90
Firm value	V_t	266.67	285.63	305.96	327.74	351.08	376.09
Return	$D_t[1-T] + V_t - V_{t-1}$		26.67	28.56	30.60	32.77	35.11
Percentage return	$\frac{D_t[1-T]+V_t-V_{t-1}}{V_{t-1}}$		0.100	0.100	0.100	0.100	0.100
Growth in firm value	$\frac{V_t-V_{t-1}}{V_{t-1}}$		0.071	0.071	0.071	0.071	0.071
Assumptions:							
Production function	$f_t(I_{t-1}) =$	$0.30g^t - 8.65(t-1)g^t \log g + 8.65g^t \log I_{t-1}$					
Opening equity		18.41					
Dividend payout rate	d	1.00					
Growth rate (operations)	g	1.07					
Discount rate	r	1.10					
Dividend tax rate	T	0.30					

Table 1.7: Numerical example assuming a 20% dividend payout rate

Period	t	0	1	2	3	4	5
Operating revenue	$f_t(I_{t-1})$		20.00	21.40	22.90	24.50	26.22
Operating assets	I_t	8.41	9.00	9.63	10.30	11.03	11.80
Operating cash flow	Y_t	-8.41	11.00	11.77	12.60	13.47	14.42
Increase in operating assets	$I_t - I_{t-1}$	8.41	0.59	0.63	0.67	0.73	0.77
Operating income	$f_t(I_{t-1}) - I_{t-1}$	0.00	11.59	12.40	13.27	14.20	15.19
Investment income	$[r-1]C_{t-1}$		1.00	1.98	3.12	4.44	5.96
Net income	X_t		12.59	14.38	16.39	18.64	21.15
Dividends	D_t		2.20	2.35	2.52	2.70	2.88
Increase in equity	$X_t - D_t$		10.39	12.03	13.87	15.94	18.27
Nonoperating assets	C_t	10.00	19.80	31.20	44.40	59.61	77.11
Operating assets	I_t	8.41	9.00	9.63	10.30	11.03	11.80
Equity	$C_t + I_t$	18.41	28.80	40.83	54.70	70.64	88.91
Firm value	V_t	354.67	388.59	425.80	466.62	511.40	560.52
Return	$D_t[1-T] + V_t - V_{t-1}$		35.47	38.86	42.58	46.66	51.14
Percentage return	$\frac{D_t[1-T]+V_t-V_{t-1}}{V_{t-1}}$		0.100	0.100	0.100	0.100	0.100
Growth in firm value	$\frac{V_t-V_{t-1}}{V_{t-1}}$		0.096	0.096	0.096	0.096	0.096
Assumptions:							
Production function	$f_t(I_{t-1}) =$	$0.30g^t - 8.65(t-1)g^t \log g + 8.65g^t \log I_{t-1}$					
Opening equity		18.41					
Dividend payout rate	d	0.20					
Growth rate (operations)	g	1.07					
Discount rate	r	1.10					
Dividend tax rate	T	0.30					

Table 1.8: Numerical example assuming no growth in production

Period	t	0	1	2	3	4	5
Operating revenue	$f_t(I_{t-1})$		20.00	20.00	20.00	20.00	20.00
Operating assets	I_t	9.00	9.00	9.00	9.00	9.00	9.00
Operating cash flow	Y_t	-9.00	11.00	11.00	11.00	11.00	11.00
Increase in operating assets	$I_t - I_{t-1}$	9.00	0	0	0	0	0
Operating income	$f_t(I_{t-1}) - I_{t-1}$	0.00	11.00	11.00	11.00	11.00	11.00
Investment income	$[r-1]C_{t-1}$		1.00	1.98	3.06	4.24	5.55
Net income	X_t		12.00	12.98	14.06	15.24	16.55
Dividends	D_t		2.20	2.20	2.20	2.20	2.20
Increase in equity	$X_t - D_t$		9.80	10.78	11.86	13.04	14.35
Nonoperating assets	C_t	10.00	19.80	30.58	42.44	55.48	69.83
Operating assets	I_t	9.00	9.00	9.00	9.00	9.00	9.00
Equity	$C_t + I_t$	19.00	28.80	39.58	51.44	64.48	78.83
Firm value	V_t	113.40	123.20	133.98	145.84	158.88	173.23
Return	$D_t[1-T] + V_t - V_{t-1}$		11.34	12.32	13.40	14.58	15.89
Percentage return	$\frac{D_t[1-T]+V_t-V_{t-1}}{V_{t-1}}$		0.100	0.100	0.100	0.100	0.100
Growth in firm value	$\frac{V_t-V_{t-1}}{V_{t-1}}$		0.086	0.087	0.088	0.089	0.900
Assumptions:							
Production function	$f_t(I_{t-1}) =$	$-1.75g^t - 9.90(t-1)g^t \log g + 9.90g^t \log I_{t-1}$					
Opening equity		19.00					
Dividend payout rate	d	0.20					
Growth rate (operations)	g	1.00					
Discount rate	r	1.10					
Dividend tax rate	T	0.30					

Table 1.9: Numerical example assuming only one period of production

Period	t	0	1	2	3	4	5
Operating revenue	$f_t(I_{t-1})$		11.00	0	0	0	0
Operating assets	I_t	9.00	0	0	0	0	0
Operating cash flow	Y_t	-9.00	11.00	0	0	0	0
Increase in operating assets	$I_t - I_{t-1}$	9.00	-9.00	0	0	0	0
Operating income	$f_t(I_{t-1}) - I_{t-1}$	0	2.00	0	0	0	0
Investment income	$[r-1]C_{t-1}$		1.00	2.20	2.42	2.66	2.93
Net income	X_t		3.00	2.20	2.42	2.66	2.93
Dividends	D_t		0	0	0	0	0
Increase in equity	$X_t - D_t$		3.00	2.20	2.42	2.66	2.93
Nonoperating assets	C_t	10.00	22.00	24.20	26.62	29.28	32.21
Operating assets	I_t	9.00	0	0	0	0	0
Equity	$C_t + I_t$	19.00	22.00	24.20	26.62	29.28	32.21
Firm value	V_t	20.00	22.00	24.20	26.62	29.28	32.21
Return	$D_t[1-T] + V_t - V_{t-1}$		2.00	2.20	2.42	2.66	2.93
Percentage return	$\frac{D_t[1-T]+V_t-V_{t-1}}{V_{t-1}}$		0.100	0.100	0.100	0.100	0.100
Growth in firm value	$\frac{V_t-V_{t-1}}{V_{t-1}}$		0.100	0.100	0.100	0.100	0.100
Assumptions:							
Production function	$f_1(I_0) =$	$-10.75 + 9.90 \log I_0$					
Opening equity		19.00					
Dividend payout rate	d	0.00					
Discount rate	r	1.10					

Table 1.10: Numerical example assuming no shocks

Period	t	0	1	2	3	4	5
Operating revenue	$f_t(I_{t-1})$		20.00	21.40	22.90	24.50	26.22
Operating assets	I_t	8.41	9.00	9.63	10.30	11.03	11.80
Operating cash flow	Y_t	-8.41	11.00	11.77	12.60	13.47	14.42
Increase in operating assets	$I_t - I_{t-1}$	8.41	0.59	0.63	0.67	0.73	0.77
Operating income	$f_t(I_{t-1}) - I_{t-1}$	0.00	11.59	12.40	13.27	14.20	15.19
Investment income	$[r-1]C_{t-1}$		1.00	1.98	3.12	4.44	5.96
Net income	X_t		12.59	14.38	16.39	18.64	21.15
Dividends	D_t		2.20	2.35	2.52	2.70	2.88
Increase in equity	$X_t - D_t$		10.39	12.03	13.87	15.94	18.27
Nonoperating assets	C_t	10.00	19.80	31.20	44.40	59.61	77.11
Operating assets	I_t	8.41	9.00	9.63	10.30	11.03	11.80
Equity	$C_t + I_t$	18.41	28.80	40.83	54.70	70.64	88.91
Firm value	V_t	354.67	388.59	425.80	466.62	511.40	560.52
Return	$D_t[1-T] + V_t - V_{t-1}$		35.47	38.86	42.58	46.66	51.14
Percentage return	$\frac{D_t[1-T]+V_t-V_{t-1}}{V_{t-1}}$		0.100	0.100	0.100	0.100	0.100
Growth in firm value	$\frac{V_t-V_{t-1}}{V_{t-1}}$		0.096	0.096	0.096	0.096	0.096
Announcement effects: dividends announced first							
Unexpected dividends	$UD_{t.1}$		0.00	0.00	0.00	0.00	0.00
Return	$V_{t.1} - V_{t.0}$		0.00	0.00	0.00	0.00	0.00
Unexpected earnings	$UE_{t.2}$		0.00	0.00	0.00	0.00	0.00
Return	$V_{t.2} - V_{t.1}$		0.00	0.00	0.00	0.00	0.00
Announcement effects: earnings announced first							
Unexpected earnings	$UE_{t.1}$		0.00	0.00	0.00	0.00	0.00
Return	$V_{t.1} - V_{t.0}$		0.00	0.00	0.00	0.00	0.00
Unexpected dividends	$UD_{t.2}$		0.00	0.00	0.00	0.00	0.00
Return	$V_{t.2} - V_{t.1}$		0.00	0.00	0.00	0.00	0.00
Assumptions:							
Transitory shock	v_t		0.00	0.00	0.00	0.00	0.00
Persistent shock	u_t		0.00	0.00	0.00	0.00	0.00
Production function	$f_t(I_{t-1}) = .3g^t - 8.65(t-1)g^t \log g + 8.65g^t \log I_{t-1} + v_t + \sum_{j=0}^{t} g^{t-j} u_j$						
Opening equity		18.41					
Dividend payout rate	d	0.20					
Growth rate (operations)	g	1.07					
Discount rate	r	1.10					
Dividend tax rate	T	0.30					

Table 1.11: Numerical example assuming transitory shocks in periods 2 and 4

Period	t	0	1	2	3	4	5
Operating revenue	$f_t(I_{t-1})$		20.00	22.40	22.90	23.29	26.22
Operating assets	I_t	8.41	9.00	9.63	10.30	11.03	11.80
Operating cash flow	Y_t	-8.41	11.00	12.77	12.60	12.26	14.42
Increase in operating assets	$I_t - I_{t-1}$	8.41	0.59	0.63	0.67	0.73	0.77
Operating income	$f_t(I_{t-1}) - I_{t-1}$	0.00	11.59	13.40	13.27	12.99	15.19
Investment income	$[r-1]C_{t-1}$		1.00	1.98	3.22	4.55	5.96
Net income	X_t		12.59	15.38	16.49	17.54	21.15
Dividends	D_t		2.20	2.35	2.52	2.70	2.88
Increase in equity	$X_t - D_t$		10.39	13.03	13.97	14.84	18.27
Nonoperating assets	C_t	10.00	19.80	32.20	45.50	59.61	77.11
Operating assets	I_t	8.41	9.00	9.63	10.30	11.03	11.80
Equity	$C_t + I_t$	18.41	28.80	41.83	55.80	70.64	88.91
Firm value	V_t	354.67	388.59	426.80	467.72	511.40	560.52
Return	$D_t[1-T] + V_t - V_{t-1}$		35.47	39.86	42.68	45.56	51.14
Percentage return	$\frac{D_t[1-T]+V_t-V_{t-1}}{V_{t-1}}$		0.100	0.103	0.100	0.097	0.100
Growth in firm value	$\frac{V_t-V_{t-1}}{V_{t-1}}$		0.096	0.098	0.096	0.093	0.096
Announcement effects: dividends announced first							
Unexpected dividends	$UD_{t.1}$		0.00	0.00	0.00	0.00	0.00
Return	$V_{t.1} - V_{t.0}$		0.00	0.00	0.00	0.00	0.00
Unexpected earnings	$UE_{t.2}$		0.00	1.00	0.00	-1.21	0.00
Return	$V_{t.2} - V_{t.1}$		0.00	1.00	0.00	-1.21	0.00
Announcement effects: earnings announced first							
Unexpected earnings	$UE_{t.1}$		0.00	1.00	0.00	-1.21	0.00
Return[1]	$V_{t.1} - V_{t.0}$		0.00	17.73	0.00	-21.46	0.00
Unexpected dividends	$UD_{t.2}$		0.00	-0.10	0.00	0.12	0.00
Return	$V_{t.2} - V_{t.1}$		0.00	-16.73	0.00	20.25	0.00
Assumptions:							
Transitory shock	v_t		0.00	1.00	0.00	-1.21	0.00
Persistent shock	u_t		0.00	0.00	0.00	0.00	0.00
Production function	$f_t(I_{t-1}) = .3g^t - 8.65(t-1)g^t \log g + 8.65 g^t \log I_{t-1} + v_t + \sum_{j=0}^{t} g^{t-j} u_j$						
Opening equity		18.41					
Dividend payout rate	d	0.20					
Growth rate (operations)	g	1.07					
Discount rate	r	1.10					
Dividend tax rate	T	0.30					

[1] Assumes that the market guesses that half unexpected earnings is transitory and half persistent.

Table 1.12: Numerical example assuming persistent shocks in periods 2 and 4

Period	t	0	1	2	3	4	5
Operating revenue	$f_t(I_{t-1})$		20.00	22.40	23.97	24.50	26.22
Operating assets	I_t	8.41	9.00	9.63	10.30	11.03	11.80
Operating cash flow	Y_t	-8.41	11.00	12.77	13.67	13.47	14.42
Increase in operating assets	$I_t - I_{t-1}$	8.41	0.59	0.63	0.67	0.73	0.77
Operating income	$f_t(I_{t-1}) - I_{t-1}$	0.00	11.59	13.40	14.34	14.20	15.19
Investment income	$[r-1]C_{t-1}$		1.00	1.98	3.20	4.61	6.15
Net income	X_t		12.59	15.38	17.54	18.81	21.34
Dividends	D_t		2.20	2.55	2.74	2.70	2.88
Increase in equity	$X_t - D_t$		10.39	12.83	14.80	16.11	18.46
Nonoperating assets	C_t	10.00	19.80	32.00	46.13	61.51	79.20
Operating assets	I_t	8.41	9.00	9.63	10.30	11.03	11.80
Equity	$C_t + I_t$	18.41	28.80	41.63	56.43	72.54	91.00
Firm value	V_t	354.67	388.59	460.13	504.23	513.30	562.61
Return	$D_t[1-T] + V_t - V_{t-1}$		35.47	73.33	46.01	10.96	51.33
Percentage return	$\frac{D_t[1-T]+V_t-V_{t-1}}{V_{t-1}}$		0.100	0.189	0.100	0.022	0.100
Growth in firm value	$\frac{V_t-V_{t-1}}{V_{t-1}}$		0.096	0.184	0.096	0.018	0.096
Announcement effects: dividends announced first							
Unexpected dividends	$UD_{t.1}$		0.00	0.20	0.00	-0.23	0.00
Return	$V_{t.1} - V_{t.0}$		0.00	34.47	0.00	-39.46	0.00
Unexpected earnings	$UE_{t.2}$		0.00	0.00	0.00	0.00	0.00
Return	$V_{t.2} - V_{t.1}$		0.00	0.00	0.00	0.00	0.00
Announcement effects: earnings announced first							
Unexpected earnings	$UE_{t.1}$		0.00	1.00	0.00	-1.14	0.00
Return[1]	$V_{t.1} - V_{t.0}$		0.00	17.73	0.00	-20.30	0.00
Unexpected dividends	$UD_{t.2}$		0.00	0.10	0.00	-0.11	0.00
Return	$V_{t.2} - V_{t.1}$		0.00	16.73	0.00	-19.16	0.00
Assumptions:							
Transitory shock	v_t		0.00	0.00	0.00	0.00	0.00
Persistent shock	u_t		0.00	1.00	0.00	-1.14	0.00
Production function	$f_t(I_{t-1}) = .3g^t - 8.65(t-1)g^t \log g + 8.65g^t \log I_{t-1} + v_t + \sum_{j=0}^{t} g^{t-j} u_j$						
Opening equity		18.41					
Dividend payout rate	d	0.20					
Growth rate (operations)	g	1.07					
Discount rate	r	1.10					
Dividend tax rate	T	0.30					

[1] Assumes that the market guesses that half unexpected earnings is transitory and half persistent.

Table 1.13: Numerical example assuming both transitory and persistent shocks in periods 2 and 4

Period	t	0	1	2	3	4	5
Operating revenue	$f_t(I_{t-1})$		20.00	22.40	23.43	23.90	26.22
Operating assets	I_t	8.41	9.00	9.63	10.30	11.03	11.80
Operating cash flow	Y_t	-8.41	11.00	12.77	13.13	12.87	14.42
Increase in operating assets	$I_t - I_{t-1}$	8.41	0.59	0.63	0.67	0.73	0.77
Operating income	$f_t(I_{t-1}) - I_{t-1}$	0.00	11.59	13.40	13.80	13.60	15.19
Investment income	$[r-1]C_{t-1}$		1.00	1.98	3.21	4.58	6.05
Net income	X_t		12.59	15.38	17.01	18.18	21.24
Dividends	D_t		2.20	2.45	2.63	2.70	2.88
Increase in equity	$X_t - D_t$		10.39	12.93	14.38	15.48	18.36
Nonoperating assets	C_t	10.00	19.80	32.10	45.81	60.56	78.15
Operating assets	I_t	8.41	9.00	9.63	10.30	11.03	11.80
Equity	$C_t + I_t$	18.41	28.80	41.73	56.11	71.59	89.95
Firm value	V_t	354.67	388.59	443.47	485.98	512.35	561.57
Return	$D_t[1-T] + V_t - V_{t-1}$		35.47	56.59	44.35	28.26	51.24
Percentage return	$\frac{D_t[1-T]+V_t-V_{t-1}}{V_{t-1}}$		0.100	0.146	0.100	0.058	0.100
Growth in firm value	$\frac{V_t-V_{t-1}}{V_{t-1}}$		0.096	0.141	0.096	0.054	0.096
Announcement effects: dividends announced first							
Unexpected dividends	$UD_{t.1}$		0.00	0.10	0.00	-0.11	0.00
Return	$V_{t.1} - V_{t.0}$		0.00	17.23	0.00	-19.73	0.00
Unexpected earnings	$UE_{t.2}$		0.00	0.50	0.00	-0.61	0.00
Return	$V_{t.2} - V_{t.1}$		0.00	0.50	0.00	-0.61	0.00
Announcement effects: earnings announced first							
Unexpected earnings	$UE_{t.1}$		0.00	1.00	0.00	-1.18	0.00
Return[1]	$V_{t.1} - V_{t.0}$		0.00	17.73	0.00	-20.88	0.00
Unexpected dividends	$UD_{t.2}$		0.00	0.00	0.00	0.01	0.00
Return	$V_{t.2} - V_{t.1}$		0.00	0.00	0.00	0.54	0.00
Assumptions:							
Transitory shock	v_t		0.00	0.50	0.00	-0.61	0.00
Persistent shock	u_t		0.00	0.50	0.00	-0.57	0.00
Production function	$f_t(I_{t-1}) = .3g^t - 8.65(t-1)g^t \log g + 8.65g^t \log I_{t-1} + v_t + \sum_{j=0}^{t} g^{t-j}u_j$						
Opening equity		18.41					
Dividend payout rate	d	0.20					
Growth rate (operations)	g	1.07					
Discount rate	r	1.10					
Dividend tax rate	T	0.30					

[1] Assumes that the market guesses that half unexpected earnings is transitory and half persistent.

Table 1.14: Dividend and earnings response coefficients, the effect on them of changes in the rates, and the predicted signs

	Dividend response coefficients		Earnings response coefficients	
	Dividends Announced First	Dividends Announced Second[1]	Earnings Announced First[2]	Earnings Announced Second[1]
Equation #	1.16	1.15	1.14, 1.18	1.17
Response coefficient	$\frac{rd^{-1}-rT}{r-g}$	$\frac{gd^{-1}-rT}{r-g}$	$1+\gamma\frac{g-drT}{r-g}$	1
	+	+	+	+
Effect on the response coefficients of a change in the:				
Dividend payout rate d	$\frac{-rd^{-2}}{r-g}$	$\frac{-gd^{-2}}{r-g}$	$\frac{-\gamma rt}{r-g}$	0
	−	−	−	0
Discount rate r	$\frac{gT-gd^{-1}}{[r-g]^2}$	$\frac{gT-gd^{-1}}{[r-g]^2}$	$\gamma\frac{dgT-g}{[r-g]^2}$	0
	−	−	−	0
Tax rate T	$\frac{-r}{r-g}$	$\frac{-r}{r-g}$	$\frac{-\gamma dr}{r-g}$	0
	−	−	−	0
Growth rate g	$\frac{rd^{-1}-rT}{[r-g]^2}$	$\frac{rd^{-1}-rT}{[r-g]^2}$	$\gamma\frac{r-drT}{[r-g]^2}$	0
	+	+	+	0

Notes:
[1] These are also the predicted effects when the dividend and earnings announcements occur at the same time, see equation 1.13.
[2] The signs of the effects on the earnings response coefficient assume the proportion γ of the earnings surprise that is persistent is positive.

Chapter 2

VARIATION IN THE EFFECTS OF EARNINGS AND DIVIDEND ANNOUNCEMENTS ON FIRM VALUE

2.1 Introduction

Although firms release much information about their financial performance, earnings and dividend announcements seem to consistently merit attention in the financial press. Documented stock market reactions suggest that these announcements provide information about firm value (even when the announcements occur within a few days of each other), yet few studies have examined the interaction between dividends and earnings announcements. Little is understood about the differences and similarities in the information that the two announcements provide about firm value. This paper develops hypotheses about, and examines empirically, the effect of earnings and dividend announcements on firm value. The effect (commonly called the earnings or dividend response coefficient) is predicted to vary with the timing of the announcements and with cross sectional and time series differences in firm specific and economy wide variables.

The seminal work demonstrating a significant association between earnings and firm value was Ball and Brown (1968). Subsequent studies have documented that the announcement of an unexpected increase in earnings increases firm value. Bowen, Johnson, and Shevlin (1989) found the relation held even in the aftermath of the October 1987 market crash. A summary of the accounting literature may be found in Watts and Zimmerman (1986 and 1990). In the finance literature, Divecha and Morse (1983) found that the announcement of dividend increases was associated with positive abnormal returns during 1977-79. Patell and Wolfson (1984) found that the stock market reacts within minutes to earnings and dividend announcements.

Table 1.1 summarizes the few studies that have considered the effect of both earnings and dividends on firm value. Kane, Lee, and Marcus (1984) regressed cumulative abnormal returns on announced earnings divided by expected earnings from a time series model, percentage change in dividends, and dummy interaction terms. Using

352 observations of contemporaneous quarterly earnings and dividend announcements in 1979-81, they found that unexpected increases in either earnings or dividends were associated with increases in firm value. When they included interaction terms, which were based on whether the earnings surprise was of the same sign as the dividend surprise, the interaction terms were generally more statistically significant than were the size of the surprises.

Kane, Lee, and Marcus examined the effect on firm value when the two announcements were made *within* a few days of each other. In contrast, Aharony and Swary (1980) studied 149 NYSE firms with dividend announcement dates from 1963-76 being at least 11 trading days *apart* from earnings announcement dates. They found that abnormal returns were significant and in the same direction as the dividend change regardless of whether earnings announcements preceded or followed dividend announcements. Abnormal returns were insignificantly different from zero when the announcement was for no change in dividends.

Brown, Choi, and Kim (1992) examine the effect on the dividend response coefficient of preceding earnings announcements. They find that the dividend response coefficient when dividends are announced more than ten days after earnings is significantly positive with a value of about 4. They find that dividends announced three to ten days after earnings are significantly positive only if the sign of the unexpected dividend differs from the sign of the unexpected earnings, and that in this case the dividend response coefficient magnitude of 2.6 is significantly less than the magnitude of 4 in the prior case.

Collins and Kothari (1989) show that the association between annual earnings and annual (or 15 month) changes in firm value is not constant across firms or through time. They show that the earnings response coefficient depends on the risk free rate, firm specific risk, earnings growth, and earnings persistence.

This paper extends the previous results by developing and testing hypotheses as to the effect of the relative timing of the two announcements on the earnings and dividend response coefficients. Announcement date earnings and dividend response coefficients are predicted to depend on the risk free rate, firm specific risk, the dividend growth rate, the dividend payout rate, and the effective tax rate on dividends.[1]

This paper provides some empirical evidence that the earnings (dividend) response

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[1] Chapter 1 of the dissertation develops these hypotheses rigorously.

coefficient is larger when earnings (dividends) are announced first, consistent with the evidence in Brown, Choi, and Kim (1992). It provides evidence that changes in the risk free interest rate, firm betas, and growth have the same effects on announcement date earnings response coefficients as Collins and Kothari (1989) found for association period earnings response coefficients.

The paper's contributions are as follows. It draws together previous work on earnings and dividend response coefficients and argues that they are affected by the same firm specific and economy wide variables. It shows that the response coefficients are affected by the timing of the announcements. It provides the first empirical evidence of the effect on the dividend response coefficient of the payout rate, the discount rate, the growth rate, and the effective dividend tax rate. It provides the first empirical evidence that the earnings response coefficient is affected by the dividend payout rate and the effective dividend tax rate.

The paper is organized as follows. Following a discussion of how the earnings and dividend response coefficients vary depending on the order of the earnings and dividend announcements and various firm specific and economy wide factors, the sample and proxies are presented. Results of the basic tests of the hypotheses are presented followed by some sensitivity analyses. The paper concludes by noting limitations and some directions for future research.

2.2 Development of hypotheses

This section develops hypotheses concerning variation in the magnitude of the earnings and dividend response coefficients.

2.2.1 Signal mitigation

Firm value equals the present value of expected future cash flows (Miller and Modigliani, 1961). If the cash flows follow a random walk, then firm value at the end of a period should equal the cash flow for the period times one plus the inverse of the discount rate. If earnings equal cash flows, then the price earnings ratio should also equal one plus the inverse of the discount rate. Panel A of table 2.1 shows a median price earnings ratio of 11.913 for the firms on the Compustat annual industrial database for the years 1981 to 1987. This would suggest that the inverse of the discount rate was about eleven, i.e. that the discount rate was about nine percent. In fact, the risk free interest rate averaged eleven percent (see table B.26).

In the random walk model all changes in earnings are persistent and the earnings response coefficient equals the price earnings ratio. On the other hand, if a change in earnings is transitory, then the change in firm value should equal the change in earnings and the earnings response coefficient should equal one. If earnings have both persistent and transitory components, then the price earnings ratio and the earnings response coefficient should be less than one plus the inverse of the discount rate, but greater than one. Nevertheless, few studies have observed an earnings response coefficient greater than one.[2]

Lintner (1956) proposed that firms change dividends only in response to a persistent increase in their cash generating ability. He also observed that most firms have a target dividend payout ratio. This suggests that the price dividend ratio should equal the inverse of the discount rate divided by the dividend payout rate. The average price dividend ratio is about 2.5 times the average price earnings ratio for the Compustat firms in table 2.1. This would suggest a 40% payout ratio if the level of persistence of earnings and dividends is similar. If the level of persistence of dividends is higher than that of earnings, because firms change their dividends only when there is a persistent change in earnings, then the suggested payout rate is also higher. The observed mean payout ratio is 40.3%.

When earnings or dividends are announced, the expected values of future cash flows are revised and firm value should change. Earnings announced in excess of the amount expected usually imply an increase in future cash flows, and so should cause an increase in firm value. If firms change dividends only in response to a persistent increase in their cash generating ability, as proposed by Lintner (1956), then dividends announced in excess of the amount expected should also lead to an increase in firm value. Since the dollar amount of the earnings or dividend surprise is generally less than the present value of the expected increase in future cash flows, the change in firm value would be larger than the amount of the surprise, i.e. the response coefficient is predicted to be greater than one. If the earnings surprise reflects a transitory change in cash flows, e.g. from the previously unreported sale of a headquarters building,

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[2] See Freeman and Tse (1991) for further discussion of this issue. Using an arctan transformation of the earnings surprise, they document response coefficients of similar size to price earnings ratios.

then the change in firm value would equal the earnings surprise, and the response coefficient would equal one.

In Miller and Rock's (1985) model, dividend and earnings announcements contain the same information about future cash flows. Thus if they were both based on the same information, the second announcement should contain no surprise and have no effect on firm value. If dividends and earnings are both noisy signals of future cash flows, then the second announcement should have less effect than the first, but it may still have a significant effect if there are few other sources of information about future cash flows.[3]

If dividends are linearly related only to persistent operating cash flows while earnings are linearly related to both transitory and persistent operating cash flows, then the market cannot determine transitory operating cash flows without both announcements. When dividends are announced before earnings, the dividend announcement provides information about current cash flows that will persist into the future; the information in the subsequent earnings announcement relates to the current transitory cash flows only. When earnings are announced before dividends, the information in the earnings announcement relates to total current cash flows; information about the extent to which the total current cash flows are persistent is contained in the subsequent dividend announcement. Thus when earnings are announced first, the earnings response coefficient should be greater than one since the market will in general expect at least some of current cash flows to be persistent. When earnings are announced second, the announcement provides information about transitory cash flows only so that the earnings response coefficient should equal one and so be smaller than the earnings response coefficient when earnings are announced first. The dividend response coefficient should always be greater than one, since the dividend announcement provides information about persistent cash flows. When dividends are announced first, the announcement provides information about both current persistent and future cash flows; when dividends are announced after earnings, the announcement provides information about future cash flows only, since the preceding earnings announcement has already provided information about current cash flows. Thus the dividend response coefficient when dividends are announced first is larger than the dividend response coefficient when dividends are announced second by the inverse of the dividend payout

[3] This argument was presented in an earlier draft of the Brown, Choi, and Kim (1992) paper.

rate. These arguments lead to the following hypotheses:[4]

> H1: The dividend response coefficient should be greater than one. The dividend response coefficient when dividends are announced first should be larger than the dividend response coefficient when dividends are announced second.

> H2: The earnings response coefficient should be greater than one when earnings are announced first and should equal one when earnings are announced second.

2.2.2 Cross sectional variation in the response coefficients

The preceding subsection hypothesized that the magnitude of the dividend and earnings response coefficients depends on the relative timing of the earnings and dividend announcements. The response coefficients (other than the earnings response coefficient when earnings are announced after dividends, which is hypothesized to always equal one) also vary depending on firm specific and economy wide variables. Since economy wide variables are the same for all firms in the economy, they are most easily examined using time series data. Firm specific variables, on the other hand, lend themselves to cross sectional analysis. Hypotheses regarding these cross sectional variations are examined in this subsection, with the economy wide variations being examined in the following subsection.

Firm value is the present value of future cash flows. Although an increase in earnings (when earnings are announced first) signals an increase in the firm's future cash flows, a higher dividend payout rate means that a higher proportion of the future cash flows will be paid out as dividends, imposing a higher tax cost on the investors. Thus the increase in firm value arising from an unexpected increase in earnings will be lower the higher the payout rate. In the case of dividend announcements, a given increase in future cash flows will occasion a larger increase in dividends, the larger is the dividend payout rate. Thus the larger the payout rate, the lower is the expected increase in each future period's operating cash flows indicated by a given increase in

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[4] These results are derived and discussed in greater detail in chapter 1 of the dissertation.

current dividends.[5]

H3: (a) The dividend response coefficient when dividends are announced first, (b) the dividend response coefficient when dividends are announced second, and (c) the earnings response coefficient when earnings are announced first are smaller for firms with a larger dividend payout rate.[6]

Changes in the discount rate used to calculate firm value affect the response coefficients. Any increase in future cash flows signalled by an unexpected increase in dividends or earnings has a lower present value the higher the firm's systematic risk.[7]

H4: (a) The dividend response coefficient when dividends are announced first, (b) the dividend response coefficient when dividends are announced second, and (c) the earnings response coefficient when earnings are announced first are smaller the larger the firm's systematic risk.

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[5] The effect on firm value of changes in dividends and dividend payout rates is discussed in more detail in the appendix to chapter 1 of the dissertation. Miller and Scholes (1978) argues that investors can effectively shelter their dividend income from taxes by leveraging their stock purchases. If their proposition is correct, then the dividend payout rate should not affect the response coefficients. Brennan (1991, p. 75) appears to argue that a higher dividend payout rate could lead to a larger earnings response coefficient, since it would imply that future dividend distributions would be higher which would increase firm value. Shefrin and Statman (1984) argues that shareholders prefer to receive dividends rather than sell part of their shareholdings when they need cash because they might subsequently regret reducing their proportionate ownership of the firm. If their proposition is correct, then the response coefficients will be larger for firms with larger payout rates. Jensen (1986) argues that corporate managers invest cash in excess of that needed for operations suboptimally, so that too low a payout rate may dampen response coefficients. On the other hand, to the extent that a firm uses its cash to pay dividends, it has less cash available to invest. In addition to the costs of raising additional equity, such as those arising from the preparation of a prospectus and from underwriter fees and commissions, Myers and Majluf (1984) argues that management may decline to undertake projects with positive net present value rather than issue share at less than what they believe to be the true firm value. This argument suggests that too high a payout rate may lower the response coefficients. If the payout rate is set optimally to trade-off all the costs of issuing dividends against the benefits, as suggested by Shleifer and Vishny (1986), Rozeff (1982) and others, then a higher payout rate suggests that a firm faces higher agency and monitoring costs implying that it will have lower response coefficients.

[6] This proposition and those that follow implicitly assume a ceteris paribus condition.

[7] Changes in the risk free rate are discussed in the following subsection.

Current persistent earnings or cash flows indicate larger future cash flows the larger the firm's growth rate.[8] Thus an unexpected increase in current earnings is predicted to produce a larger effect on firm value the larger the growth rate. If an unexpected increase in dividends signals that management believes that the firm will have increased operating cash flows, then the change in firm value should be larger the larger the growth rate.

> H5: (a) The dividend response coefficient when dividends are announced first, (b) the dividend response coefficient when dividends are announced second, and (c) the earnings response coefficient when earnings are announced first are larger the larger the firm's growth rate.[9]

2.2.3 Time series variation in the response coefficients

As noted above, firm value is the present value of future cash flows. If the risk free interest rate increases, then firm value decreases. Any increase in future cash flows signalled by an unexpected increase in dividends or earnings has a lower present value the higher the risk free rate.

> H6: (a) The dividend response coefficient when dividends are announced first, (b) the dividend response coefficient when dividends are announced

[8] Firm growth can be measured in several ways, such as the percentage increase in: (net) (operating) assets, equity, operating cash flow, net income, dividends. It can be caused by: reinvesting profits rather than distributing them, increases in production efficiency due to technology changes, increases in customer demand, decreases in input prices, etc. The various measures of growth converge as the dividend payout rate approaches one and as the transitory component of income approaches zero. Chapter 1 of the dissertation discusses this issue in more detail.

[9] The hypothesis makes predictions about the response coefficients of different firms based on their contemporaneous growth rates; it does not address the effects of a *change* in an individual firm's growth rate. An increase in a firm's growth rate might require larger inputs which would initially reduce cash flow. Since the effect of the growth rate increase would be persistent, dividends would increase under Lintner's (1956) model or the model developed in chapter 1 of the dissertation. However, under models which require that dividends equal current period outputs less inputs for the following period, dividends could initially decrease when a firm experienced an increase in its growth rate. Ghosh and Woolridge (1988) document that some firms do explain a decrease in dividends as being due to unexpected investment opportunities. Their empirical evidence suggests that the market does not put much credence in such explanations.

second, and (c) the earnings response coefficient when earnings are announced first are smaller the larger the risk free interest rate.

Although dividends may provide information about a firm not otherwise available to the market, the receipt of dividends imposes a tax cost on individual investors in excess of what the tax cost would be if they received the cash when it was needed for immediate consumption. Elton and Gruber (1970), Modigliani (1984), and others have argued that the market value of the firm should be reduced by the present value of the net tax cost of the expected stream of future dividends. The increase in firm value arising from an unexpected increase in dividends is dampened by this tax cost. To the extent that an unexpected increase in earnings announced before dividends is due to a persistent increase in cash flow, it suggests an increase in dividends also.

H7: (a) The dividend response coefficient when dividends are announced first, (b) the dividend response coefficient when dividends are announced second, and (c) the earnings response coefficient when earnings are announced first are smaller in periods in which the effective tax rate on dividends is larger.

Note again that this hypothesis compares the response coefficient across periods with differing tax rates. Firms with higher payout rates may attract investors with lower effective tax rates on dividends which would cause the response coefficients to vary across firms. However, in this case both the tax cost and the payout rate would be varying, and empirical tests would need to address both hypotheses.

2.3 Proxies and sample

This section discusses the proxies used for the constructs in the hypotheses and the sample used to test the hypotheses. The first two subsections address the proxies for the first two hypotheses, and the following two subsections discuss the proxies for the firm specific rates and the economy wide rates respectively. The sample selection criteria are discussed concurrently with the proxy discussion. Table 2.2 summarizes the sample selection criteria, and table 2.3 summarizes the proxies.

2.3.1 Signal mitigation

The first set of hypotheses (H1 and H2) requires determining earnings and dividend announcement dates, measuring respectively the earnings and dividend surprises, and measuring the market reaction to the announcements. Because most publicly traded firms make such announcements quarterly, the sample consists of firms listed on both the Compustat quarterly industrial database and the CRSP monthly and daily NYSE database for the eight years 1980 to 1987 which meet certain criteria. Firms which did not have prices and returns for each quarter in 1980 to 1987 on the CRSP database were eliminated. Firms that announced earnings or dividends less frequently than quarterly were also excluded from the sample. Firms whose fiscal yearend was other than December were eliminated so that the date of determining firm value and the expected time between quarter end and earnings announcement was the same for all firms.

Announcement dates

The more precisely the announcement time can be identified, the more narrow the event window can be, and the more powerful the test for information content. Compustat (item rdoqe) gives the date the earnings announcement appeared in *The Wall Street Journal*, but this is often the business day after the earnings were released. Thus the earnings announcement event window is the Compustat date and the trading day before it.

CRSP provides the day of the dividend declaration. In many cases this information does not appear in *The Wall Street Journal* till the following day. Thus the dividend announcement event window is the CRSP date plus the trading day following it.

The earnings announcement occurs a few weeks after the end of the period and is based primarily on information available at the end of the period.[10] In many theoretical models,[11] dividends and earnings are determined and announced at the end of each period and so are based on the same transactions and information. In fact,

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[10] More correctly, earnings are computed based on the transactions occurring during the period. Although most of the information relating to those transactions is obtained during the period, generally accepted accounting principles require that the financial statements be adjusted for information obtained after the period end if it relates to transactions occurring during the period.

[11] E.g. Miller and Rock (1985), chapter 1 of the dissertation.

almost every day some firm announces dividends. In order to decide whether the dividend announcement occurs before or after the earnings announcement, some rule needs to be established as to which period or which earnings announcement each dividend announcement relates to.[12] Since most firms announce quarterly earnings within the first five weeks of the following quarter, dividends announced during the first five weeks of a quarter were assumed to relate to the previous quarter's information set. Dividends announced in the last four weeks of a quarter were assumed to relate to that quarter since it seemed that they would be based to a large extent on that quarter's performance. Dividends announced in the middle four weeks of a quarter were assumed to relate to the previous quarter since it seemed more likely that they were based on the prior quarter's performance than on the current quarter's.

Returns

The market reaction is measured by the percentage change (the return) in common share prices including dividends since this is the usual definition in earnings response studies and the data is readily available. In most of the tests, market adjusted returns are used; these are the firm's common stock returns less the CRSP equally weighted market return.[13]

Unexpected dividends

Since the market value of common shares was selected to proxy for firm value, common share dividends were selected to proxy for dividends. Most dividends are paid in cash and are fully taxable; in order to ensure similar proxies for all firms, firms that paid dividends that were not taxable, such as those which include a return of capital, were excluded from the sample.

[12] Note that a firm could announce its dividends exactly midway between two earnings announcements. Since assuming such a dividend relates to either earnings announcement is arbitrary, the tests were also performed restricting the data to dividend announcements made within two weeks of an earnings announcement.

[13] Brown and Warner (1985) found that adjusting returns for firm betas added little power over those adjusting returns for the overall market return in tests involving small event windows. Though the earnings announcement dates cluster about a month following the end of each quarter, they are spread over a sufficient number of days that market wide factors should not have much effect on the regression results.

Lintner (1956) proposed that a reduction in dividends signals management's belief that future cash flows will be lower than previously believed.[14] If the relation is linear, then zero future cash flows should be associated with zero dividends and negative future cash flows should be associated with negative dividends. However it is difficult to justify the continued existence of a firm with zero or negative future cash flows. The reasons for the elimination or suspension of dividends by a firm which is apparently a going concern and the manner in which the market interprets the situation are thus beyond the scope of this paper. Firms were therefore removed from the sample if they did not declare a cash dividend every quarter.[15]

It is common in empirical studies to view any change in dividends as unexpected. Thus a possible proxy for unexpected dividends *UD* would be:

$$\begin{aligned} UD_t &= D_t - E_{t-1}\{D_t\} \\ &= D_t - D_{t-1}. \end{aligned}$$

where D_t is dividends for period t and E_t is expectations based on information available at the end of period t. Although such a proxy is common in studies using annual data, when quarterly data is used it is sometimes argued that expected dividends are those from the same quarter a year ago, rather than those of the previous quarter. Then a possible proxy for unexpected dividends would be:

$$\begin{aligned} UD_t &= D_t - E_{t-1}\{D_t\} \\ &= D_t - D_{t-4}. \end{aligned}$$

A more sophisticated model would recognize that many firms change dividends once a year.[16] Thus the first proxy proposed above could be adjusted to reflect any change in dividends occurring between the same quarters of the previous year(s):

$$UD_t = D_t - E_{t-1}\{D_t\}$$

[14] This issue is discussed in more detail in chapter 1 of the dissertation.

[15] To reiterate: this paper examines the relation between firm value, earnings, and dividends. Thus the sample firms must pay dividends. Future research could compare dividend paying firms to firms that do not pay dividends or only pay them irregularly or start or cease to pay dividends.

[16] For these firms it is not clear whether dividends announced in the three quarters in which they do not normally change dividends convey information. The implications of this observation for hypotheses H1 and H2 are discussed below.

$$= D_t - \{D_{t-1} + \lambda[D_{t-4} - D_{t-5}]\}.$$

The coefficient λ could be estimated from previous data[17] or could be arbitrarily set to one. The second proxy proposed above could be adjusted similarly:

$$\begin{aligned} UD_t &= D_t - E_{t-1}\{D_t\} \\ &= D_t - \{D_{t-4} + \lambda[D_{t-1} - D_{t-5}]\}. \end{aligned}$$

Again the coefficient λ could be estimated from previous data or could be arbitrarily set to one. Note that if λ is set to one, then the last two proxies are the same:

$$\begin{aligned} UD_t &= D_t - E_{t-1}\{D_t\} \\ &= D_t - \{D_{t-1} + [D_{t-4} - D_{t-5}]\} \\ &= D_t - \{D_{t-4} + [D_{t-1} - D_{t-5}]\}. \end{aligned}$$

This last proxy is the one used in this paper.

Unexpected earnings

Some previous studies have measured earnings using income before extraordinary items; others have used income after extraordinary items. Since both transitory and persistent increases in earnings are of concern, the proxy used is primary earnings per share including extraordinary items and after deducting preferred dividends (Compustat item D11). As for expected dividends, some studies have equated expected earnings to earnings in the prior quarter, while others have equated expected earnings to earnings in the same quarter of the prior year. More sophisticated Box Jenkins models of expected earnings have also been explored, as have proxies using analysts' forecasts. In the absence of a clear consensus as to the best proxy for expected earnings, and desiring to keep data collection and manipulation costs to a minimum, the proxy for unexpected earnings UE is similar to that for unexpected dividends:

$$UE_t = X_t - E_{t-1}\{X_t\} = X_t - X_{t-1} - [X_{t-4} - X_{t-5}].$$

where X_t is earnings for period t.

[17] Obtaining the necessary data would however reduce the sample size.

As recommended by Christie (1987), the earnings and dividends surprises are scaled by the market value of the firm's common shares at the start of the announcement window. For consistency with the scaling implicit in the measure of returns, earnings and dividends ideally should also be scaled by the firm's market value at the close of two days before the earnings announcement and at the close of the day before the dividend declaration respectively. Unfortunately, daily price data is not available in machine readable form at the University of Washington. Therefore unexpected earnings and dividends for each quarter are scaled by firm market value at the end of the quarter.

Table 2.4 shows the distribution of the 270 sample firms across industries. 27 quarters of data are available for each firm, giving 7290 observation. Table 2.1 compares some characteristics of the sample to that of all firms on the Compustat database. Note that the second quartiles of each of dividends, earnings, and value of the sample firms are in the fourth (top) quartiles respectively of all firms on Compustat. The price earnings ratios of the sample are comparable to that of all firms on Compustat, while the price dividend ratios are lower and the payout ratios are higher. The requirement that the sample firms pay dividends every quarter in the eight years 1980 to 1987 biases the sample to larger and more stable firms.

2.3.2 Measuring response coefficients

As discussed in the prior section, observed price earnings ratios suggest that the market views earnings as consisting of both transitory and persistent components. Unexpected earnings presumably consist of both transitory and persistent components also. Indeed it seems reasonable to assume that unexpected earnings contain a larger transitory component than annual earnings, so that the earnings response coefficient should be less than the price earnings ratio, but greater than or equal to one. Yet, as stated before, few studies have observed earnings response coefficients greater than one.

Freeman and Tse (1991) show that the earnings response coefficient obtained in the usual regression of returns UR on unexpected earnings UE equals a weighted average of the ratios of returns to unexpected earnings:[18]

$$RC = \sum_i w_i UR_i / UE_i$$

where

$$w_i = UE_i^2 / \sum_j UE_j^2$$

Five reasons for this calculation to be less than one are advanced. First, returns may be measured over the wrong period. For instance, Collins and Kothari (1989) show that where the independent variable is the annual change in earnings, the appropriate period is fifteen months. However, to suppose that in announcement studies returns should be measured over more than a couple of trading days (if not hours!) is to question the efficient market hypothesis.

Second, unexpected earnings may be measured incorrectly. Judge et al. (1985, p. 708) show that random errors in measuring the independent variable in an univariate regression lead to biasing the estimated response coefficient towards zero, and biasing the intercept away from zero. Collins and Kothari (1989) attempt to mitigate this problem by using reverse regression.

Third, unexpected earnings may be overstated, particularly when expected earnings are calculated using old information. For instance, if the proxy for unexpected earnings uses only earlier earnings announcements, it ignores other information the market may obtain up to the time immediately before the new earnings announcement. Regardless of the sign of the calculated earnings surprise, the magnitude is likely larger than the market's real surprise. If, for example, the calculated surprise is always twice the actual surprise, the calculated response coefficient will be half the actual response coefficient.

Fourth, the slope coefficient may not be constant. The usual regression of returns on unexpected earnings implicitly assumes that the true earnings response coefficient is the same for all observations in the sample. If the earnings response coefficients varies, as predicted in hypotheses H3 to H7, then Judge et al. (1985, p. 807) show that the estimated response coefficient is again biased towards zero.

Fifth, the assumption of a linear form may be invalid.[19] Freeman and Tse (1991)

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[18] Assuming that the means of both *UR* and *UE* are zero.

[19] Note that this may be viewed as a special case of the fourth point.

argue that the response coefficient decreases as the earnings surprise increases, since larger earnings surprises are less persistent. Note that the weights w_i in the usual regression are larger for the larger earnings surprises, so that the estimated earnings response coefficient is more affected by the observations with primarily transitory earnings surprises than by observations with primarily persistent earnings surprises. Freeman and Tse's arctan transformation corrects this problem and they do indeed calculate earnings response coefficients greater than one. Nevertheless, if incorrect weighting were the only problem, then the usual regression results should be biased to one, not to zero.

If the true intercept is zero, and there is no economic (as opposed to econometric) reason for believing it is not,[20] then there is no clear reason for using regression as the statistical tool to estimate the response coefficients. Instead, the ratios of returns to unexpected earnings can be used directly. Estimating the response coefficients by using the mean of the observed ratios of returns to earnings surprises is equivalent to assigning the weights w_i to one. This solution can be viewed as a middle ground between the usual regression estimate, which assigns larger weights to observations with larger earnings surprises, and the Freeman and Tse estimate, which assigns larger weights to observations with smaller earnings surprises, in that it assigns the same weight to each observation, regardless of the size of the earnings surprise.[21] For comparison with previous studies, regression results are reported in the section on sensitivity tests, but the main results are obtained using the ratios directly.

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[20] And the model developed in chapter 1 of the dissertation argues that the true intercept is indeed zero.

[21] Observations with small surprises (less than .0001 times firm value) were assigned a weight of zero, on the assumption that such small amounts were due to differences in rounding (e.g. 10 2/3 being coded once as 10.667 and later as 10.6667) by Compustat, since they correspond to a surprise of less than one cent per share on a share priced at \$100. Response coefficients calculated using such observations would likely be large in absolute value and would probably reduce the reported significance levels. Widening the exclusion could reduce the number of usable observations which would reduce the power of the tests. It could eliminate some outliers that would affect the calculation of the mean response coefficients and the regression coefficients.

2.3.3 Cross sectional variation in the response coefficients

Hypothesis H3, H4, and H5 predict that the response coefficient RC should be a function of the dividend payout rate d, systematic risk r, and the growth rate g:

$$RC = \phi(d, r, g)$$

with the response coefficient increasing when the payout rate decreases, the risk decreases, or the growth rate increases.

A proxy for the payout rate d could be calculated for each firm-quarter by dividing the dividend for that quarter by the earnings for the quarter. However if dividends are not adjusted for transitory shocks,[22] then such a calculation would introduce considerable error in the proxy. Instead a proxy for each firm's payout rate (for all quarters) was calculated by dividing the total dividends paid over the eight years 1980 to 1987 by the total net income for the eight years.[23] This measure should contain less error on average since the proportion of transitory shock to net income over 32 quarters should be less than the same proportion in any given quarter.

Each firm's systematic risk r was proxied for by its beta calculated by regressing its monthly returns over the full eight years against equal weighted monthly market returns.

The percentage change in dividends was used to proxy for growth g.[24] Each firm's growth rate was estimated by regressing the log of dividends on the calendar quarter for the eight years 1980 to 1987.

Note that all three proxies use data for all thirty-two quarters, which therefore include information not available to the market at the announcement dates. Some studies estimate such proxies using data available to the market only. This alternate procedure would produce an estimate of each firm's payout rate, beta, and growth

[22] As suggested by Lintner (1956) and the model in chapter 1 of the dissertation.

[23] The payout rate d in the model in chapter 1 of the dissertation is the ratio between dividends and persistent operating cash flow. Data on operating cash flow is available for only half the firms in the sample. See table C.13 which indicates that operating cash flow is available for 3571 of the 7532 firm quarters.

[24] As noted in the prior section, alternate measures of growth would use assets, equity, operating cash flow, or net income. Chapter 1 of the dissertation explains why the best theoretical measure of growth is persistent operating cash flow, and why dividends should grow at the same rate.

rate in each quarter which would allow time series tests of the hypotheses for each firm in the sample. However, the procedure would also require data on each firm for 1973 to 1979 which would have reduced the number of firms in the sample. If the three rates are constant for each of the firms[25] then little is gained by this alternate procedure. If the rates change over time, then additional analysis to determine the effect of such changes on firm value would be appropriate. Such analysis, which should consider why the rates would change, how such changes would be conveyed to the market, and how the conveyance of such information would interact with earnings and dividend announcements, is beyond the scope of this paper.

2.3.4 Time series variation in the response coefficients

Hypothesis H6 and H7 predict that the response coefficient RC should be a function of the risk free interest rate r, and the effective tax rate on dividends T:

$$RC = \psi(r, T)$$

with the response coefficient increasing when the risk free interest rate decreases or the effective tax rate on dividends decreases.

The ten year constant maturity market yield on government securities obtained from the S & P Statistical Services (1990) was used to represent the quarterly interest rate r.[26]

The tax rate of concern T is the expected effective tax rate on future dividends. The increase in the tax rate on capital gains and the general reduction in tax rates in the 1986 Tax Reform Act lowered the effective tax rate on dividends after 1986. To the extent this reduction was anticipated, the expected effective tax rate would have begun to decrease prior to passage of the Act. Thus the proxy for tax rates is the calendar quarter, with the earlier quarters 1981:2 to 1983:1 proxying for higher

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[25] Which is explicitly assumed in the model in chapter 1 of the dissertation on which the hypotheses are based.

[26] Note that this is a nominal rather than a real rate of interest. The paper assumes throughout that growth rates, discount rates, rates of return, and projections of future amounts are calculated using nominal, not real, dollars. However, if a change in the quarterly interest rate reflects a change in inflation expectations that was already anticipated, the proxy measures the construct with error.

tax rates and the later ones 1986:1 to 1987:4 for lower tax rates.[27]

2.4 *Results of the empirical tests of the hypotheses*

2.4.1 *Signal mitigation*

Table 2.5 reports the quartiles and means of the response coefficients measured as the ratio of market adjusted returns to scaled unexpected earnings or dividends. It also reports two tail probabilities of the null hypotheses that the mean or median is equal to zero or one. For comparability with earlier studies, dividend and earnings response coefficients calculated without regard to the relative timing of their announcements are presented in rows 1, 4, 7, and 10. The mean dividend response coefficient for the 1409 observations in which the dividend surprise exceeds .0001 in absolute value is 11.393, which is significantly greater than one (one tail p-value less than 0.0001). The median dividend response coefficient is 4.256 which is also significantly greater than one. The number of observations (1409) is greater than the sum of the 497 observations for the case when dividends are announced first and the 675 observations for the case when dividends are announced second, since 237 dividend surprises were announced within a day of the earnings announcement.

As predicted by hypothesis H1, the mean dividend response coefficient when dividends are announced before earnings of 9.642 is significantly greater than one (one tail p-value of .0005);[28] the median of 4.846 is also significantly greater than one (one tail p-value of .0001). The mean dividend response coefficient when dividends are announced after earnings of 8.668 is significantly greater than one (one tail p-value of .0070) and the median value of 2.652 is also significantly greater than one (one tail p-value of .0124). The results for the case when the announcements are within two

[27] If the elimination of the capital gains exclusion was not anticipated, or at least the effect of the elimination on the determination of firm values was not effective till after passage of the Tax Reform Act, then including the first three quarters of 1986 in the proxy may be inappropriate. However, given that the Treasury tax reform proposals were first released in November 1984, that Congress began to address the legislation in September 1985, and that repeal of the 60% capital gains exemption created little controversy (Arthur Andersen, 1987, p. 3, 5, 34), inclusion of all the 1986 quarters does not seem inappropriate. Using fewer quarters would also reduce the power of the tests.

[28] Recall that the table presents two tail p-values, since these are relevant to the tests of hypothesis H2.

weeks of each other are similar, though the significance levels are somewhat less (.0762 for the one tail p-value for the median dividend response coefficient when dividends are announced after earnings).

Hypothesis H1 also predicts that the dividend response coefficient should be larger when dividends are announced first than when dividends are announced second. Although the magnitude of the mean (median) dividend response coefficient when dividends are announced first exceeds the magnitude of the mean (median) dividend response coefficient when dividends are announced second, whether or not the data is restricted to announcements being within two weeks of each other, tests of the mean dividend response coefficient cannot reject the null hypothesis that they are equal.[29]

The earnings response coefficient when earnings are announced before dividends is predicted (H2) to be greater than one. The mean of the 3321 observed response coefficients is 1.748 which is greater than zero (one tail p-value of .0104) but is not significantly different from one (one tail p-value of .1610). The median observed value of 0.246 is significantly greater than zero, but significantly less than one. The 2042 observations in which earnings are announced less than two weeks before dividends have a mean earnings response coefficient of 2.703 which is significantly greater than one (one-tail p-value of .0348) though the median of 0.246 is still significantly less than one. Thus the data supports the predicted sign but not the predicted magnitude of the earnings response coefficient.

The earnings response coefficient when earnings are announced after dividends is predicted (H2) to equal one. The 2442 observations have a mean of 0.636 which is not significantly different from one (two tail p-value of .5681). The median is 0.189 which is significantly less than one. The 726 observations for earnings announcements following the dividend announcement by less than two weeks have similar means and medians. Thus the means are consistent with the hypothesis H2, but the medians are not.

Hypothesis H2 also predicts that the earnings response coefficient should be larger when earnings are announced before dividends than in the reverse case. The mean in the first case of 1.748 is greater than the mean of 0.636 in the reverse case, but the

[29] Pooled standard deviation is estimated as $\left(\frac{496*58.446^2+674*80.847^2}{496+674}\right)^{0.5} = 72.204$. The t statistic is $\frac{9.642-8.668}{72.204*(1/497+1/675)^{0.5}} = 0.228$, which corresponds to a one tail p-value of 0.41.

difference is only marginally significant.[30] The mean of 2.703 of the earnings response coefficients when earnings are announced less than two weeks before dividends is also marginally significantly greater (one tail p-value of .12) than the mean of 0.720 of the earnings response coefficients when earnings are announced less than two weeks after dividends.

The appendix reports a variety of other tests of these hypotheses. The response coefficients were grouped by firm and quarters and then averaged. The response coefficients were recalculated using raw returns instead of market returns and the tests repeated. Virtually all the tests provide significant support for hypothesis H1 that the dividend response coefficients are greater than one; only the tests using raw returns and restricting the announcements to being within two weeks of each other produce some contradictory results. The results of the tests of hypothesis H1 are generally consistent with the results in Brown, Choi, and Kim (1992, table 3), though they find generally smaller response coefficients, and in particular find a dividend response coefficient of 0.941 when dividends are announced less than two weeks after earnings. Since they use regression analysis, their estimated response coefficients may be biased towards zero. Bajaj and Vijh (1990, table 6) find dividend response coefficients of 1.6 for dividend decreases and 5.0 for dividend increases. They do not distinguish dividend announcements made before earnings from those made after earnings. Most other tests of dividend response coefficients have been concerned with the sign of the response coefficient, not the magnitude, and so their results are not directly comparable to these here.

All the mean dividend response coefficients when dividends are announced before earnings are larger than the mean dividend response coefficients when dividends are announced after earnings, but the p-values range from .03 to .41. The median response coefficients are also generally larger in the first case than in the second. Table 2 of an earlier draft of the Brown, Choi, and Kim (1992) paper reported a significant difference between the dividend response coefficients when dividends are announced first compared to that when dividends are announced second.

The observed mean earnings response coefficients, when earnings are announced first, are almost always greater than one, but generally not significantly so. As noted

[30] Pooled standard deviation is estimated as $\left(\frac{3320*43.553^2+2441*31.537^2}{3320+2441}\right)^{0.5} = 38.917$. The t statistic is $\frac{1.748-0.636}{38.917*(1/3321+1/2442)^{0.5}} = 1.07$, which corresponds to a one tail p-value of 0.14.

earlier, studies using regression nearly always find response coefficients less than one, which suggests that this study's use of ratios has indeed reduced the bias implicit in those tests. On the other hand, the median earnings response coefficients are consistently less than one. Such a low response coefficient may be due to the proxy for the earnings surprise overestimating the true surprise, or due to the market taking more than two days to react to the earnings announcement.

For most of the tests, hypothesis H2 that the mean earnings response coefficient when earnings are announced second equals one cannot be rejected. However, the median response coefficient is almost always significantly less than one. There are no comparable studies of this hypothesis. Again, such a low response coefficient may be due to the proxy for the earnings surprise overestimating the true surprise, or due to the market taking more than two days to react to the earnings announcement.

All the mean earnings response coefficients when earnings are announced before dividends are larger than the mean earnings response coefficients when earnings are announced after dividends, but the differences are generally only marginally significant (p-values range from .02 to .27). The median response coefficients are also almost always larger in the first case than in the second. Table 4 of an earlier draft of the Brown, Choi, and Kim (1992) paper reported a significant difference between the earnings response coefficients when earnings are announced first compared to that when earnings are announced second for firms in their bottom market quartile, but not for firms in their top market quartile.

Note that the average dividend response coefficients are about a quarter of the average price dividend ratios, while the average earnings response coefficients are less than a tenth of the average price earnings ratios. This suggests that the market views earnings and dividend surprises to have a larger transitory component than do earnings and dividends themselves, and that earnings surprises have a larger transitory component than dividend surprises. It may also suggest that the earnings and dividend surprises are overestimated and/or that the market takes more than two days to react to the surprises. This problem is particularly acute for the proxies for the surprise in the second announcement. Presumably the market uses the information in the first announcement to revise its estimate of the information content of the second announcement, but the proxies used in this paper use the same information for both announcements. Moreover, given the few days that elapse between most of the pairs of announcements it is unlikely that any published estimates of the revision in expectations exist. Thus the observed response coefficients for the second announcements are likely more overstated than for the first announcements, which would explain the difficulty in obtaining significant support for the hypotheses that the response coefficient at the second announcement is smaller than the response coefficient at the first announcement, and for the hypothesis that the earnings response coefficient when earnings are announced second equals one.

There is another hindrance to observing a significant difference between the response coefficient at the first announcement and that at the second announcement. As mentioned earlier, many firms set their dividends annually. For the remaining three quarters in which the dividend announcement is simply a confirmation of the previous decision of the Board of Directors, the dividend announcement contains little information beyond a confirmation that nothing drastic has happened to change the firm's future cash flows. In these quarters the order of the two announcements probably has little effect on the magnitude of the earnings response coefficient and including them in the tests of hypothesis H2 likely reduces the power of the tests.

2.4.2 Univariate tests of the variation in the dividend and earnings response coefficients

Table 2.6 reports univariate tests of hypotheses H3, H4, and H5. For the univariate tests of hypothesis H3, the firms were ranked by the size of their dividend payout rates. Firms whose dividend payout rates are in the two middle quartiles (i.e. between 36% and 64.1%) were dropped from the analysis. The first and third columns compare the mean of the response coefficients for firm in the lowest payout rate quartile (i.e. the firms whose payout rate was less than 36%) to the mean of the response coefficients for firms in the highest payout rate quartile (i.e. the firms whose payout rate was more than 64.1%). The second and fourth columns compare the mean rank of the response coefficients for firms in the lowest payout rate quartile to the mean rank of the response coefficients for firms in the highest payout rate quartile. Columns one and two use all the firms in the lowest and highest quartiles; columns three and four compare only the firms whose announcements are made within two weeks of each other. The tests reported in columns one and three are parametric t tests and assume that the distribution is normal. The tests reported in columns two and four are nonparametric Wilcoxon tests which typically have lower power, but impose no assumptions as to the distribution of the data.

The tests of hypotheses H4 and H5 are of the same nature. For hypothesis H4, the firms were ranked by their beta, and the firms whose betas are in the middle two quartiles were dropped from the analysis. For hypothesis H5, the firms were ranked by their dividend growth rate, and the firms whose growth rates are in the middle two quartiles were dropped from the analysis.

Test results for hypothesis H3c, which predicts that the earnings response coefficient when earnings are announced before dividends should be larger the smaller the dividend payout rate, are reported in the fifth row. The first two columns report the results of tests which compare the earnings response coefficients when earnings are announced first of firms whose payout rate exceeds 64.1% (that is, their payout rate is in the top quartile of payout rates[31]) with the earnings response coefficients when earnings are announced first of firms whose payout rate is less than 36% (that is, their payout rate is in the bottom quartile of payout rates). The first column reports the result of a t test which compares the mean of the response coefficient for the firms whose payout rates are in the top quartile to the mean of the response coefficients for the firms whose payout rate is in the bottom quartile. The one tail probability of observing the data given the null hypothesis that the means are equal is .094; one can accept the alternate hypothesis that the mean in the first group is lower than the mean in the second group with 90.6% confidence.

The second column reports the results of a Wilcoxon nonparametric test which compares the mean of the ranks of the response coefficients of the firms whose payout rates are in the top quartile with the mean of the ranks of the response coefficients of the firms whose payout rates are in the bottom quartile. Again the null can be rejected; the probability that it holds is less than .001.

The second two columns report the results of the same tests for the earnings response coefficients when the earnings announcement precedes the dividend announcement by less than two weeks. Again the tests indicate that the null hypothesis can be rejected. In summary, each of the four tests reported in the fifth row supports hypothesis H3c.

The second row reports the results of four tests of hypothesis H3a. Each test

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[31] See table B.25 for quartiles of the payout rates.

indicates that dividend response coefficients, when dividends are announced before earnings, are generally lower when dividend payout rates are higher, but that the difference is not statistically significant.

The third row reports the results of four tests of hypothesis H3b. The mean dividend response coefficient when dividends are announced after earnings of firms in the top payout quartile is significantly lower (one tail p-value of .069) than the mean dividend response coefficient when dividends are announced after earnings of firms in the bottom payout quartile. The test permits acceptance of hypothesis H3b. The remaining three tests reported in the third row indicate that the relation is in the predicted direction, but is not statistically significant.

Rows 14 and 15 of table 2.6 report the results of tests of hypotheses H5a and H5b. The tests indicate that dividend response coefficients are statistically higher for firms whose dividend growth rates are in the top quartile than for firms whose dividend growth rates are in the bottom quartile. The seventeenth row provides similar support for hypothesis H5c.

The eighth, ninth, and eleventh rows report the results of the tests of hypotheses H4a, H4b, and H4c respectively. Although there is some evidence to support hypothesis H4a in the t test for announcements made within two weeks of each other, all remaining evidence on the three hypotheses is insignificant.

These univariate tests implicitly assume no significant relations among firm payout rates, betas, and growth rates. Indeed their correlation coefficients computed using all 270 firms are less than 13% in absolute value. However many firms appear to be in the extreme quartiles (i.e. the first and fourth quartiles) for two or three of the rates. For instance, 21 firms are in both the bottom growth quartile and the top payout quartile (being 31% of either quartile), while 42 firms are in both the top growth quartile and the bottom payout quartile (being 62% of either quartile). Thus the tests of hypotheses H3 and H5 are not completely independent; the significance of the tests of the payout rate may be driven by the strength of the relation between the growth rate and the response coefficients. Similarly, 36 firms are in both the bottom beta quartile and the top payout quartile (being 53% of either quartile) and 27 firms are in both the top beta quartile and the bottom payout quartile (being 40% of either quartile). Thus it is difficult to obtain significant support for both hypotheses H3 and H4; if the relation between the payout rate and the response coefficients is too strong, it may cause the observed relation between the betas and the response coefficients to be in the opposite direction to that hypothesized.

Table 2.7 reports the results of univariate tests of hypotheses H6 and H7. The fifth row indicates that the earnings response coefficients when earnings are announced before dividends are higher in quarters with higher interest rates, contrary to hypothesis H6c. The second row indicates that dividend response coefficients when dividends are announced before earnings are lower in quarters with higher interest rates, and that the relation is significant when the announcements are less than two weeks apart, in accordance with hypothesis H6a. The t tests in the third row provide statistically significant support for hypothesis H6b.

The ninth row of table 2.7 indicates that dividend response coefficients when dividends were announced after earnings where significantly lower in 1982 and 1983 when the effective tax rates on dividends were high compared to 1986 and 1987 when the effective tax rates on dividends were lower, in accordance with hypothesis H7b. Similar support for hypothesis H7a is presented in the eighth row, though the evidence is only statistically significant for the observations in which the dividend announcements preceded the earnings announcement by less than two weeks. The evidence regarding hypothesis H7c reported in row 11 is mixed, with the t tests of means suggesting that the relation is in the direction hypothesized, while the Wilcoxon tests of mean ranks indicate that the relation is in the opposite direction to that hypothesized.

Again it should be noted that the tests of the two hypotheses are not independent. All seven of the interest rates in the bottom interest rate quartile occurred in 1986-87, the two years with the lowest effective tax rates on dividends, and five of the seven interest rates in the top interest rate quartile occurred in 1981-82, the two years with the highest effective tax rates on dividends.

In summary, the univariate tests provide statistically significant support for hypotheses H3b, H3c, H5a, H5b, H5c, H6a, H6b, H7a, and H7b. The tests indicate that the relation is opposite to that hypothesized in H6c, and provide mixed results for the remaining hypotheses.

2.4.3 Multiple regression tests of the variation in the dividend and earnings response coefficients

This subsection reports on tests of hypotheses H3 to H7 using regression. Although regression tests are superior to those reported in the preceding subsection in that they do not implicitly assume that the rates are uncorrelated but rather permit all the rates to vary simultaneously, regression tests are inferior in that they assume the relation between the response coefficients and the rates is linear (or can be transformed into a linear form) and that the response coefficients are normally distributed. Thus the regression tests are joint tests of the hypothesized relation and the hypotheses that the response coefficients are normal and that the relation between the response coefficients and the rates is linear (or a specified transformation of a linear relation).[32]

Since the exact form of the relation between the response coefficients and the rates is not hypothesized, regressions are run assuming a linear and a log linear relation. Since only the observations with positive response coefficients and rates can be used in the log transformation, a direct comparison of the results of the log linear regression to the results of the linear regression is not possible since differences in the results could be due either to the transformation itself or to the reduced set of observations used. For this reason, regression tests using the linear form and the positive observations only are also reported. Comparing the results of this regression with that of the linear regression using all the observations shows the effect of dropping the negative observations, while comparing the results of this regression with the log linear regression shows the effect of the transformation.

Since whether the linear or the log linear form is the best approximation to the true relation between the response coefficients and the rates in unclear and indeed may vary depending on the particular set of rates observed, the choice of the best specification is an empirical issue and may vary as the data varies. In the tests that

[32] Chapter 1 of the dissertation develops an explicit form for the relation between the response coefficients and the rates. The form is not linear, nor can it be transformed into a linear form by any commonly used transformation. Response coefficients could be calculated from the observed rates using the formulas in chapter 1 of the dissertation. The calculated response coefficients could be compared to the observed response coefficients by regressing one on the other and evaluating whether the regression coefficient was significantly different from one, or at least positive. However, if the test did not support the chapter 1 formulation, it would be difficult to identify which of the hypotheses developed in this paper should be rejected.

follow, White's χ^2 test and the adjusted R^2 are used as indicators of the goodness of the specification. White's test is specifically designed to test the goodness of the specification including whether the error terms are homoscedastic; low reported values of the test suggest that the regression results may be invalid. Although R^2s are not specifically designed to test the specification, low R^2s do suggest that the specified form does not explain much of the variance in the response coefficients.

Tests of variation in the dividend response coefficient, when dividends announced first

Table 2.8 reexamines hypotheses H6a and H7a using all the observations in which the dividend announcement preceded the earnings announcement, and the dividend surprise is nonzero. The first pair of rows indicates that there were 497 such observations.[33] White's χ^2 test indicates that the equation is misspecified; the adjusted R^2 is zero. Using only the 295 positive dividend response coefficients results in a better specified regression with a 3.29% adjusted R^2. The regression coefficient on the quarterly interest rates is significantly negative as predicted by hypothesis H6a. Using the 177 positive dividend response coefficients in the first eight and last eight quarters and including the tax rate dummy in the regression increases the adjusted R^2 to 5.88% but produces insignificant regression coefficients. The variance inflation factor indicates the presence of some multicollinearity between the two proxies, as discussed in the previous section.[34] Performing the regression using the logs of the variables produces similar results.

Regressing the 138 dividend response coefficients when the dividend announcement precedes the earnings announcement by less than two weeks on the interest rate produces an R^2 of 2.73% and significant (.014) support for hypothesis H6a. Including the tax rate dummy in the equation again indicates that the relation between the response coefficients and the independent variables is in the direction hypothesized by H6a and H7a, but the tests are not significant. Similar results are obtained when only the positive response coefficients are used and the regression is performed using

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[33] As also reported in table 2.5.

[34] Recall that all seven of the interest rates in the bottom interest rate quartile occurred in 1986-87, the two years with the lowest effective tax rates on dividends, and five of the seven interest rates in the top interest rate quartile occurred in 1981-82, the two years with the highest effective tax rates on dividends.

the log transformation. In summary, the univariate support for hypothesis H6a is stronger than that in table 2.7, but the multivariate support for hypotheses H6a and H7a is weaker than that in table 2.7.

Table 2.9 reexamines hypotheses H3a, H4a, H5a, H6a, and H7a. The first pair of rows again reports that there were 497 observations in which the dividend announcement preceded the earnings announcement and the dividend surprise was nonzero. White's χ^2 test indicates that the equation is misspecified; the adjusted R^2 is zero. Using only the 294 positive dividend response coefficients results in a better specified regression with a 4.12% adjusted R^2. Although the regression coefficients are in the direction predicted by hypotheses H3a, H4a, and H5a, only the last one is statistically significant. Including the quarterly interest rate in the regression increases the adjusted R^2 to 6.76% and produces a significant regression coefficient on the interest rate as predicted by hypothesis H6a. Including the tax rate dummy and using the 176 observations in the first eight and the last eight quarters produces a significant regression coefficient for the dummy as predicted by hypothesis H7a, but eliminates the statistical significance of the regression coefficient on the interest rate variable and reverses the sign of the coefficients on the payout rate and the beta. Running the regressions in log form produces results which are similar but generally somewhat more significant.

The regressions using all the data with announcements within two weeks of each other exhibit low R^2s. Regressing the 83 positive dividend response coefficients when dividends are announced less than two weeks before earnings on the three firm rates produces an adjusted R^2 of 10.98%, a significantly negative coefficient on the dividend payout rate, and coefficients that are marginally (.16) significant on the beta and the growth rate. Adding the quarterly interest rate to the regression gives a significant coefficient on that rate but decreases the significance of the growth rate coefficient. Adding the tax rate dummy produces a very low R^2 and insignificant regression coefficients. Using the log transformation produces similar results.

In summary, table 2.9 provides evidence that some of the variation in positive dividend response coefficients when dividends are announced before earnings can be explained by the dividend growth rate (hypothesis H5a) and the quarterly interest rate (hypothesis H6a). The dividend payout rate provides additional explanatory power (hypothesis H3a) when the announcements are less than two weeks apart.

The regression coefficients on the firm beta and the quarterly tax rate dummy are generally in the directions predicted (hypotheses H4a and H7a respectively) but are not statistically significant.

Tests of variation in the dividend response coefficient, when dividends announced second

Table 2.10 provides evidence on hypotheses H6b and H7b additional to that in table 2.7. The first pair of rows reports the results of regressing the 675 dividend response coefficients when dividends are announced after earnings on the quarterly interest rates. The slope coefficient provides significant support for hypothesis H6b, but the results should be interpreted with caution due to the low R^2 and the misspecification indicated by White's χ^2. Using only the 367 positive response coefficients produces similar results. Using the log transformation produces a better specified equation and an R^2 of 6.18%. The regression coefficient on the quarterly interest rates is again significantly negative as predicted by hypothesis H6b. Adding the tax rate dummy and using only the 229 observations in the first eight and last eight quarters produces a significantly positive regression coefficient as predicted by hypothesis H7b, but the regression coefficient on the interest rate is now positive. Using the observations when the dividend announcement follows the earnings announcement by less than two weeks produces similar results.

Table 2.11 provides the results of additional tests of hypotheses H3b, H4b, H5b, H6b, and H7b. Using the 675 dividend response coefficients when the dividend announcement follows the earnings announcement produces a misspecified equation with low R^2. Regressing the 367 positive dividend response coefficients also produces misspecified equations, though the R^2s are somewhat better.[35]

Using the log transformation on the 367 observations with positive response coefficients produces a well specified equation which explains 12% of the variation in

[35] The slope coefficients provide significant support for hypotheses H3b and H5b, but the slope coefficient on the beta is contrary to that predicted in hypothesis H4b. Adding the quarterly interest rate produces a significantly negative coefficient as predicted by hypothesis H6b and leaves the other results unchanged. Adding the tax rate dummy and using only the 229 observations in the first eight and last eight quarters improves the specification and gives a significantly positive coefficient on the dummy as predicted by hypothesis H7b, but reduces the significance of the payout rate and the interest rate.

the response coefficients. The regression coefficients provide significant support for hypotheses H3b, H4b, and H5b. Adding the quarterly interest rate increases the explanatory power to 16% and provides support for hypothesis H6b also. Adding the tax rate dummy and dropping the middle quarterly observations increases the explained variance to 21% and provides significant support for hypothesis H7b, but produces a regression coefficient on the quarterly interest rates opposite to that predicted by hypothesis H6b.

Using only the observations in which the dividend announcement follows the earnings announcement by less than two weeks produces regressions that are generally better specified but whose slope coefficients are generally less significant.

In summary, the tables indicate that some of the variation in the positive dividend response coefficients when the dividend announcement follows the earnings announcement can be explained by time series variation in the effective tax rate on dividends (hypothesis H7b) and by time series variation in the interest rate (hypothesis H6b) although the two effects are difficult to separate with the data used in this study. The variation can also be explained by cross sectional variation in the dividend payout rate (hypothesis H3b) and the growth rate (hypothesis H5b) and to a lessor extent by variation in firm betas (hypothesis H4b).

Tests of variation in the earnings response coefficient, when earnings announced first

Table 2.12 provides the results of additional tests of hypotheses H6c and H7c. Using the 3321 earnings response coefficients when earnings are announced before dividends produces insignificant results and a low R^2. Regressing the 1839 positive earnings response coefficients on the quarterly interest rates produces a significantly negative regression coefficient as predicted by hypothesis H6c. Adding the tax rate dummy and using only the 1087 positive response coefficients in the first eight and last eight quarters gives a significantly positive slope on the dummy as predicted by hypothesis H7c, but a positive slope on the interest rate contrary to hypothesis H6c. Using the log transformations provides misspecified equations.

Regressing the 2042 earnings response coefficients for the observations in which the earnings announcement precedes the dividend announcement by less than two weeks produces insignificant results and a low R^2. Adding the tax rate dummy produces a significantly positive coefficient on the dummy, but leaves the R^2 still very low and changes the sign of the regression coefficient on the interest rate.

Using the 1125 positive earnings response coefficients for the observations in which the earnings announcement precedes the dividend announcement by less than two weeks produces a significantly negative slope coefficient for the interest rate in accordance with hypothesis H6c. Adding the tax rate dummy again reverses the sign of this coefficient although the slope coefficient on the dummy is significantly positive as predicted by hypothesis H7c. Using the log transforms on these observations again produces misspecified equations.

Table 2.13 provides additional evidence on hypotheses H3c, H4c, H5c, H6c, and H7c. Using all 3321 earnings response coefficients for the observations in which the earnings announcements precede the dividends announcements produces insignificant results, low R^2s, and rather low χ^2s. Regressing the 1834 positive earnings response coefficients on the firm rates produces a significant regression coefficient on the dividend growth rate in accordance with hypothesis H5c. The other two slope coefficients are insignificant. Adding the quarterly interest rate has little effect on these coefficients but does provide support for hypothesis H6c. Adding the tax rate dummy has little effect on the regression coefficients for the firm rates, but again reverses the sign of the interest rate slope and gives a significantly positive slope on the dummy in accordance with hypothesis H7c. Using the log transformation produces similar results except that the coefficients on the payout rate and the betas are now not only positive, but significantly so, contrary to hypotheses H3c and H4c, and the coefficient on the interest rate when the tax rate dummy is included is also significantly positive contrary to hypothesis H6c. Using the observations in which the two announcements are less than two weeks apart produces similar results.

In summary, the tables provide support for the effects on the earnings response coefficients when earnings are announced before dividends of time series changes in interest rates (hypothesis H6c) and the effective tax rates on dividends (hypothesis H7c) but the two effects are difficult to isolate with this data. Hypothesis H5c is strongly supported, but hypotheses H3c and H4c are not.

2.4.4 *Summary of the test results of the variation in the dividend and earnings response coefficients*

The appendix reports a variety of other tests of these hypotheses. The response coefficients were grouped by firm or quarter and then averaged. Univariate tests of means and mean ranks, and multivariate regression test were performed on the averaged data. The response coefficients were recalculated using raw returns instead of market adjusted returns and the tests repeated.

Tests of the relation between the dividend payout rate and the dividend response coefficient, when dividends are announced first, provide significant support for hypothesis H3a only in regressions of positive response coefficients observed in the two weeks before the earnings announcement. Tests of the relation between the dividend payout rate and the dividend response coefficient, when dividends are announced second, generally provide significant support for hypothesis H3b, though the support is less significant when the medians of the firms' response coefficients are used rather than the means, and when the negative response coefficients are included in the regressions. Tests of the relation between the dividend payout rate and the earnings response coefficient, when earnings are announced first, provide significant support for hypothesis H3c only in the univariate tests. The relation is insignificant in the multiple regression tests. Overall it is not clear whether the weak support for hypothesis H3 is due to poor proxies and tests or to the relative lack of importance of firms' payout policies possibly because investors can shelter any unwanted dividend distributions.

Bajaj and Vijh (1990) find a significantly positive relation between dividend yield and the magnitude of the abnormal returns at the dividend announcement date, even after controlling for the magnitude of the dividend surprise. They attribute this result to the preference on the part of some investors for dividends rather than capital gains. Given the presumably high correlation between dividend yield and dividend payout rate, their hypothesized clientele effect would explain why the evidence on the payout rate hypothesis is not very significant. On the other hand, their hypothesis would suggest that one should observe a positive relation between response coefficients and payout rates, but such a relation is observed in few of the tests here. Additional research to reconcile their results to those in this paper seems warranted.

Tests of the relation between the firm's beta and their dividend response coefficient, when dividends are announced first, produce insignificant results, contrary to hypothesis H4a. Tests of the relation between the firm's beta and their dividend response coefficient, when dividends are announced second, produce significant support for hypothesis H4b only when positive response coefficients are regressed using the log transformation. Tests of the relation between the firm's beta and their earnings response coefficient, when earnings are announced first, produce significant support for hypothesis H4c only when the medians of each firm's ERCs are regressed in the linear form or are used in univariate t tests of difference of means. Collins and Kothari (1989) found a significant inverse relation between the earnings response coefficients and firms' betas.

Tests of the relation between the dividend growth rate and the three response coefficients indicate that it is positive as predicted by hypothesis H5, and the majority of tests are significant. Collins and Kothari (1989) also find a positive relation between the earnings response coefficient and the growth rate, though their growth rate is proxied for by the growth in shareholders' equity. The relation between the dividend response coefficients and the dividend growth rate has not been previously documented.

Tests of the relation between the risk free interest rate and the dividend response coefficient, when dividends are announced first, support hypothesis H6a, though the results are insignificant in most of the univariate tests of quartiles and in the multivariate tests which include the tax rate dummy. However, it should be remembered that the tax rate dummy could also proxy for interest rates, so that the poor results on the multivariate tests may be due to poor proxies. Tests of the relation between the risk free interest rate and the dividend response coefficient, when dividends are announced second support hypothesis H6b, though the results are insignificant in some of the univariate tests of quartiles and in the multivariate tests which include the tax rate dummy. Tests of the relation between the risk free interest rate and the earnings response coefficient, when earnings are announced first, are generally insignificant, with only the tests of the positive earnings response coefficients using all the data and excluding the tax rate dummy from the regression providing significant support for hypothesis H6c. Collins and Kothari (1989) document support for hypothesis H6c. The significant relation between the dividend response coefficients and the risk free interest rate has not been previously reported. It is interesting that the tests support the effect on the dividend response coefficients of the risk free interest rate but not of the firm betas.

Tests of the relation between the effective tax rate on dividends and the dividend response coefficient, when dividends are announced first, are generally insignificant, with only some of the tests using raw returns providing significant support for hypothesis H7a. On the other hand, tests of the relation between the effective tax rate on dividends and the dividend response coefficient, when dividends are announced second, provide significant support for hypothesis H7b, except for the regression tests which include the negative response coefficients and some of the regression tests using the averages of the quarters' response coefficients. Regression tests of the relation between the effective tax rate on dividends and the earnings response coefficient, when earnings are announced first, generally provide significant support for hypothesis H7c, while the univariate tests of the quarter quartiles are insignificant. These hypotheses have not been previously examined, however the results should be treated with caution since it is possible that they are driven more by the lower interest rates in 1986-87 compared to 1982-83 than by the reduction in the effective tax rate on dividends.

Overall, it is curious that the hypotheses on the variation of the dividend response coefficient, when dividends are announced second, are generally supported, while only some of the hypotheses on the variations in the dividend or earnings response coefficient when that announcement is first are supported.

2.5 Summary and conclusion

Over the last quarter century, research has evolved from demonstrating the *existence* of a significant relation between stock market prices and dividends and earnings to investigating the *determinants* of the relation. This paper has added to that investigation by examining the magnitude, rather than merely the sign, of the relation. It has also demonstrated that the relation is affected by the relative timing of the earnings and dividend announcements and by certain firm specific and economy wide factors.

The paper hypothesized, and provided some evidence, that response coefficients should be greater than one. Statistical tests that produce response coefficients less than one suffer from serious biases that may weaken the power of the tests. In a regression setting, these biases may arise from errors in measuring the independent variables and from variations in the true relation between the dependent and the independent variables. This paper proposed that the bias can be reduced by computing response coefficients as ratios, rather than as regression coefficients.

The paper hypothesized, and provided some evidence, that the magnitude of dividend and earnings response coefficients are affected by their relative timing. Further research is necessary to determine if the response coefficients are affected by the relative timing of other announcements. For instance, the introduction stated that earnings and dividend announcements appear to receive the most press attention. Sales also receive substantial attention, yet there is no clear theoretical reason for this. Future research could investigate whether some firms announce sales because sales are less subject to accounting manipulation than are earnings, or because sales provide important time series information about operating activities, in particular with respect to their growth and persistence.

The paper hypothesized, and provided some evidence, that dividend and earnings response coefficients are larger the larger the dividend growth rate and the smaller the dividend payout rate, the discount rate, and the effective tax rate on dividends. Further research may be necessary to determine if other rates also impact the magnitude of the response coefficients.

The empirical evidence uses the quarterly 1981-87 data of 270 NYSE listed firms. The selection criteria biased the sample to the larger, more stable firms in the American economy. Generalization of the results to smaller firms, firms in other countries, and other time periods should be done cautiously. The results of the tests might also be different if different proxies, statistical tests, or functional forms were used. Future research in the area could involve further tests of the hypotheses using different proxies, particularly for expected earnings, expected dividends, and the effective tax rate on dividends.

Some firms announce earnings and dividends on the same day while others announce them weeks apart. Some firms consistently announce earnings first, some announce dividends first, while others change the order of the announcements from time to time. It is not clear what motivates these timing differences, and in particular whether the differences reflect the contents of the announcements. Future research could investigate the determinants of the order of announcements, extending the literature on the timing of earnings announcements.

Table 2.1: Descriptive statistics for firm value, earnings, and dividends

	Mean	St D	Min	Max	Q1	Q2	Q3	Obs
Panel A: All firms on Compustat annual industrial database								
Dividends	20.424	110.640	0.000	5495.894	0.000	0.000	4.577	32106
Price	16.762	37.073	0.010	2950.000	3.625	11.000	23.000	27007
Shares	18.784	66.238	0.000	2939.415	2.222	5.091	13.505	32108
Earnings	40.106	224.460	-4407.000	7136.894	-0.125	1.723	15.402	32040
Value	496.477	2132.513	0.000	95697.500	11.024	46.086	227.298	26960
P/E ratio	21.137	57.461	0.000	3084.726	8.026	11.913	18.526	19041
P/D ratio	53.473	103.137	0.000	4008.809	17.922	30.117	55.033	12531
Payout ratio	0.403	2.173	0.000	187.111	0.000	0.164	0.426	22188
Panel B: Firms in sample								
Dividends	103.838	247.343	0.551	2741.000	14.763	42.400	100.000	1863
Price	37.206	21.911	6.500	345.000	24.062	32.750	44.625	1864
Shares	55.649	87.930	1.733	1379.442	12.411	29.315	64.303	1865
Earnings	200.675	505.956	-1230.000	6582.000	26.019	84.400	210.223	1865
Value	2316.321	5417.598	18.915	95697.500	366.210	1018.048	2446.675	1863
P/E ratio	18.374	92.790	2.640	3084.726	7.901	10.746	14.710	1770
P/D ratio	32.797	66.170	6.439	1729.058	15.583	23.727	35.460	1863
Payout ratio	0.836	5.342	0.007	187.111	0.311	0.446	0.634	1770

Notes:
Table provides the mean, the standard deviation, the minimum, the maximum, the first, second, and third quartiles, and the number of observations, and the reference for each variable measured for each year 1981 to 1987. The variables are defined as follows (Compustat definitions are given in parentheses):
Dividends are the total millions of dollars of dividends (other than stock dividends) declared on the common stock of the company during the year (D21: Dividends - common).
Price is the price in dollars of the closing transaction for the year (bid price for over-the-counter issues) (D24: Price - close).
Shares are the net millions of all common shares outstanding at year-end, excluding treasury shares and scrip (D25: Common shares outstanding).
Earnings is the income in millions of dollars for the year after extraordinary items and discontinued operations less preferred dividend requirements and is adjusted for the additional dollar savings due to common stock equivalents as outlined in APB Opinion No. 15 (D258: Net income adjusted for common stock equivalents).
Value is the year-end common stock market value of the firm in millions of dollars (price * shares).
P/E ratio is the price earnings ratio for the year (price * shares / earnings).
P/D ratio is the price dividends ratio for the year (price * shares / dividends).
Payout ratio is the ratio of earnings to dividends for the year.
The P/E and payout ratios are not calculated in cases when earnings are less than $100,000.
The P/D ratio is not calculated in cases when dividends are less than $100,000.

Table 2.2: Data selection criteria

Number of firms on CRSP monthly NYSE database	3911
Number of firms on CRSP daily NYSE/AMEX returns database	5968
Firms on both CRSP databases	3382
Number of firms on Compustat quarterly industrial database	7028
Firms on both CRSP and Compustat databases	1598
Less firms whose price data ends before 1980	17
Less firms whose returns data ends before 1980	0
	1581
Less firms whose price data ends before April 1988	32
Less firms whose returns data ends before April 1988	0
	1549
Less firms whose price data begins after 1980	656
Less firms whose returns data begins after 1980	1
	892
Less those firms whose last dividend declaration date is before November 1987	142
	750
Less those firms whose first dividend declaration date is after July 1980	27
	723
Less those firms which paid dividends other than ordinary taxable dividends or stock dividends	141
	582
Less firms not disclosing primary earnings per share including extraordinary items	20
	562
Less firms with other than calendar quarter yearend	198
Less firms with other than December yearend	76
	388
Less firms that do not have a dividend each quarter	41
	347
Less firms that have more than one cash dividend in a quarter	23
	324
Less firms with an irregular pattern of cash dividends	40
	284
Less firms missing earnings announcement dates	14
Firms in sample	270

Table 2.3: Constructs, proxies, and predicted coefficients for tests of the variation in the announcement date response coefficients

Theoretical model		Empirical model	
Construct	Coefficient	Proxy	Coefficient
Unexpected dividends		Annual change in quarterly dividend change	
Unexpected earnings		Annual change in quarterly earnings change	
Dividend response coefficient	> 1	Market adjusted returns / unexpected dividends	> 1
Earnings response coefficient	> 1	Market adjusted returns / unexpected earnings	> 1
Dividend payout rate	-	Dividends / net income	-
Discount rate (risk)	-	Market model beta	-
Growth rate	+	Growth in quarterly dividends	+
Discount rate (interest)	-	Yield on 10 year government bonds	-
Tax rate	-	Biennium	1986-87 largest

Table 2.4: Distribution of sample among industries

Number		SIC
20	1000	Mining
2	1500	Construction
2	2000	Manufacturing: food
0	2100	Manufacturing: tobacco
3	2200	Manufacturing: textile
1	2300	Manufacturing: apparel
3	2400	Manufacturing: lumber
0	2500	Manufacturing: furniture
2	2600	Manufacturing: paper
1	2700	Manufacturing: printing
19	2800	Manufacturing: chemicals
0	2900	Manufacturing: petroleum
3	3000	Manufacturing: rubber
0	3100	Manufacturing: leather
3	3200	Manufacturing: stone, clay, glass
6	3300	Manufacturing: primary metal
8	3400	Manufacturing: fabricated metal
22	3500	Manufacturing: industrial machinery
19	3600	Manufacturing: electronic and electric
6	3700	Manufacturing: transportation
10	3800	Manufacturing: instruments
3	3900	Manufacturing: misc.
30	4000	Transportation and public utilities
40	5000	Wholesale and retail trade
23	6000	Finance, insurance, and real estate
44	7000	Services
270		

Table 2.5: Tests of signal mitigation (H1 - H2): evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, where the response coefficients are measured as market adjusted returns divided by the unexpected change in dividends or earnings

Hypothesis			Mean	St D	Prob0	Prob1	Q1	Q2	Q3	Prob2	Prob3	Obs
1		DRC_0	11.393	79.420	.0001	.0001	-12.436	4.256	28.316	.0001	.0001	1409
2	H1	DRC_1	9.642	58.446	.0003	.0010	-10.538	4.846	26.397	.0001	.0001	497
3	H1	DRC_2	8.668	80.847	.0055	.0140	-16.832	2.652	27.471	.0032	.0248	675
4		ERC_0	1.319	37.486	.0030	.4728	-1.862	0.214	3.567	.0001	.0001	7121
5	H2	ERC_1	1.748	43.553	.0208	.3221	-2.103	0.246	4.150	.0001	.0001	3321
6	H2	ERC_2	0.636	31.537	.3194	.5681	-1.709	0.189	2.641	.0001	.0001	2442
When data restricted to announcements being within two weeks of each other												
7		DRC_0	12.829	87.968	.0001	.0002	-12.654	4.774	30.516	.0001	.0001	780
8	H1	DRC_1	11.869	49.528	.0056	.0110	-9.046	5.737	28.617	.0034	.0110	138
9	H1	DRC_2	7.307	84.901	.0840	.1357	-19.358	2.864	26.213	.0531	.1525	405
10		ERC_0	1.957	38.172	.0010	.1074	-1.826	0.200	3.774	.0001	.0001	4126
11	H2	ERC_1	2.703	42.393	.0040	.0697	-2.004	0.246	4.057	.0001	.0009	2042
12	H2	ERC_2	0.720	38.280	.6125	.8438	-1.737	0.154	2.719	.0458	.0001	726

Notes:
Table provides the mean, the standard deviation, the (two tail) probability of observing the mean given the null hypothesis that the mean is zero (Prob0) or one (Prob1), the first, second, and third quartiles, the (two tail) probability of observing the median given the null hypothesis that the median is zero (Prob2) or one (Prob3), and the number of observations, for each response coefficient, where the response coefficient is calculated as returns divided by unexpected earnings or dividends. ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.
Total observations in the sample are 7290 (= 270 firms * 27 quarters). The table excludes cases where scaled unexpected dividends or earnings are between -0.0001 and $+0.0001$.
Proxies:
Returns are two day returns over the announcement window less the market return.
Unexpected earnings are announced earnings less expected earnings scaled by firm value at the end of the quarter.
Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.
Unexpected dividends are announced dividends less expected dividends scaled by firm value at the end of the quarter.
Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table 2.6: Univariate cross sectional tests of hypotheses H3 - H5: evidence of variation in the response coefficients due to cross sectional variation in firm payout rates, firm betas, and firm dividend growth rates: probability (1 tail) of observing the difference in the mean (t test) or the mean rank (wilcoxon test) of the response coefficients between the first and fourth quartiles of the rates, given the null hypotheses of no difference.

Hypotheses			All announcements		Announcements within 2 weeks of each other	
			t test	w test	t test	wilcoxon test
Effect on the response coefficients of changes in the dividend payout rate						
1		DRC_0	.007	.137	.009	.134
2	H3a	DRC_1	.332	.317	.251	.409
3	H3b	DRC_2	.069	.269	.194	.276
4		ERC_0	.004	.000	.004	.036
5	H3c	ERC_1	.094	.000	.034	.010
6		ERC_2	.076	.123	.309	.580
Effect on the response coefficients of changes in the beta						
7		DRC_0	.951	.663	.812	.558
8	H4a	DRC_1	.387	.360	.077	.299
9	H4b	DRC_2	.894	.606	.620	.308
10		ERC_0	.573	.956	.710	.941
11	H4c	ERC_1	.260	.406	.626	.517
12		ERC_2	.684	.984	.399	.937
Effect on the response coefficients of changes in the dividend growth rate						
13		DRC_0	.000	.003	.001	.019
14	H5a	DRC_1	.060	.091	.202	.334
15	H5b	DRC_2	.029	.038	.061	.070
16		ERC_0	.001	.000	.000	.000
17	H5c	ERC_1	.044	.000	.004	.000
18		ERC_2	.021	.332	.063	.222

Notes:
ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.
See table 2.3 for proxy definitions.

Table 2.7: Univariate time series tests of hypotheses H6 and H7: evidence of variation in the response coefficients due to time series variation in the risk free interest rate and the effective tax rate on dividends: probability (1 tail) of observing the difference in the mean (t test) or the mean rank (wilcoxon test) of the response coefficients between the first and fourth quartiles of the rates, given the null hypotheses of no difference.

Hypotheses			All announcements		Announcements within 2 weeks of each other	
			t test	w test	t test	wilcoxon test
Effect on the response coefficients of changes in the interest rate						
1		DRC_0	.026	.191	.011	.139
2	H6a	DRC_1	.337	.418	.072	.074
3	H6b	DRC_2	.061	.134	.061	.222
4		ERC_0	.111	.537	.264	.966
5	H6c	ERC_1	.569	.948	.524	.997
6		ERC_2	.053	.061	.386	.634
Effect on the response coefficients of changes in the effective tax rate on dividends						
7		DRC_0	.004	.062	.006	.072
8	H7a	DRC_1	.207	.269	.038	.034
9	H7b	DRC_2	.041	.064	.104	.204
10		ERC_0	.053	.277	.064	.771
11	H7c	ERC_1	.154	.807	.153	.920
12		ERC_2	.154	.017	.221	.324

Notes:
ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.
See table 2.3 for proxy definitions.

Table 2.8: Regression tests of hypotheses H6a and H7a: evidence on the time series variation in dividend response coefficients, when dividends announced first

$$\text{Response coefficient} = b_0 + b_1 * \text{Interest rate} + b_2 * \text{Tax rate dummy}$$

	Obs	b_0	b_1	b_2	Adjusted R^2	White's χ^2	Largest VIF
		Predicted:	−	+			
		Hypothesis:	H6a	H7a			
1	All	20.271	-0.958		.0000	.0069	
	497	.157	.226				
2	All	3.856	-1.162	0.187	.0000	.0392	4.144
	305	.988	.342	.474			
3	Pos	87.397	-4.407		.0329	.0848	
	295	.000	.001				
4	Pos	-206.927	-1.857	3.149	.0588	.1278	3.999
	177	.414	.244	.122			
5	Log	5.210	-0.962		.0154	.2709	
	295	.000	.009				
6	Log	0.994	-0.713	0.043	.0255	.3902	4.591
	177	.917	.227	.314			
When data restricted to announcements being within two weeks of each other							
7	All	64.611	-4.664		.0273	.1474	
	138	.009	.014				
8	All	-214.202	-1.878	2.862	.0285	.4755	3.636
	85	.579	.326	.244			
9	Pos	95.286	-5.243		.0448	.3809	
	84	.001	.014				
10	Pos	-130.774	-2.706	2.302	.0532	.4309	3.658
	47	.742	.270	.294			
11	Log	7.784	-2.026		.0705	.8191	
	84	.000	.004				
12	Log	7.843	-1.819	-0.007	.0774	.2939	4.290
	47	.591	.116	.521			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)
See table 2.3 for proxy definitions.

Table 2.9: Multivariate regression tests of hypotheses H3a to H7a: evidence on the variation in dividend response coefficients, when dividends announced first

$$\text{Response coefficient} = b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} + b_3 * \text{Dividend growth rate} + b_4 * \text{Interest rate} + b_5 * \text{Tax rate dummy}$$

	Obs	b_0	b_1	b_2	b_3	b_4	b_5	Adjusted R^2	White's χ^2	Largest VIF
		Predicted:	−	−	+	−	+			
		Hypothesis:	H3a	H4a	H5a	H6a	H7a			
1	All	-204.570	-1.421	-0.739	212.174			.0000	.0039	1.054
	497	.199	.286	.463	.088					
2	All	-190.747	-1.343	-0.810	207.784	-0.843		.0000	.0052	1.057
	497	.236	.297	.460	.093	.254				
3	All	-199.246	-0.956	2.737	194.486	-1.009	0.216	.0000	.1408	4.174
	305	.564	.358	.604	.179	.363	.470			
4	Pos	-497.078	-9.622	-8.379	538.792			.0412	.1404	2.126
	294	.025	.266	.208	.006					
5	Pos	-437.710	-7.112	-7.344	521.936	-3.991		.0676	.2906	2.132
	294	.046	.320	.234	.006	.001				
6	Pos	-844.241	7.542	1.971	545.811	-0.856	3.934	.0698	.3522	4.124
	176	.046	.648	.562	.028	.376	.076			
7	Log	2.876	-0.733	-0.166	18.387			.0715	.9524	2.228
	294	.000	.161	.186	.001					
8	Log	4.696	-0.636	-0.147	18.168	-0.774		.0804	.6709	2.238
	294	.000	.194	.212	.001	.026				
9	Log	-1.991	-0.376	-0.064	15.589	-0.324	0.066	.0486	.7975	4.760
	176	.837	.361	.398	.036	.368	.230			
When data restricted to announcements being within two weeks of each other										
10	All	-183.201	-1.674	-8.939	200.014			.0000	.0824	1.040
	138	.344	.222	.227	.146					
11	All	-75.036	-1.231	-10.421	143.838	-4.430		.0171	.2401	1.051
	138	.706	.286	.189	.224	.022				
12	All	-187.914	-0.884	1.869	-11.398	-1.907	2.674	.0000	.8021	3.761
	85	.677	.342	.551	.517	.326	.266			
13	Pos	-249.809	-46.576	-14.921	319.890			.1098	.6807	2.377
	83	.430	.049	.159	.141					
14	Pos	-141.633	-44.431	-17.092	250.259	-3.324		.1194	.6086	2.384
	83	.662	.057	.127	.202	.088				
15	Pos	-673.584	22.533	9.267	482.614	-1.663	2.546	.0033	.9515	3.878
	46	.383	.670	.674	.187	.363	.289			
16	Log	3.803	-2.521	-0.209	9.860			.1367	.8386	2.420
	83	.000	.030	.253	.124					
17	Log	6.736	-2.358	-0.251	7.612	-1.247		.1544	.7196	2.434
	83	.001	.038	.211	.187	.053				
18	Log	6.739	1.943	0.583	13.727	-1.627	-0.010	.0546	.5628	4.633
	46	.670	.792	.913	.183	.154	.527			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)
See table 2.3 for proxy definitions.

Table 2.10: Regression tests of hypotheses H6b and H7b: evidence on the time series variation in dividend response coefficients, when dividends announced second

Response coefficient $= b_0 + b_1 *$ Interest rate $+ b_2 *$ Tax rate dummy

	Obs	b_0	b_1	b_2	Adjusted R^2	White's χ^2	Largest VIF
		Predicted:	$-$	$+$			
		Hypothesis:	H6b	H7b			
1	All	39.194	-2.747		.0041	.0004	
	675	.015	.027				
2	All	-203.864	-0.419	2.602	.0027	.0012	4.949
	415	.566	.454	.246			
3	Pos	145.114	-8.541		.0601	.0192	
	367	.000	.000				
4	Pos	-646.344	-1.091	8.439	.0720	.0391	5.150
	229	.156	.409	.041			
5	Log	7.444	-1.837		.0618	.5303	
	367	.000	.000				
6	Log	-21.288	0.647	0.271	.1199	.8290	5.874
	229	.031	.749	.002			
When data restricted to announcements being within two weeks of each other							
7	All	36.108	-2.608		.0020	.0063	
	405	.098	.089				
8	All	-446.950	2.341	5.133	.0000	.0170	5.364
	243	.389	.670	.177			
9	Pos	166.516	-10.438		.0770	.1218	
	216	.000	.000				
10	Pos	-969.514	0.620	12.088	.0829	.1404	5.679
	130	.168	.534	.053			
11	Log	7.828	-1.973		.0787	.5036	
	216	.000	.000				
12	Log	-32.219	1.658	0.373	.1600	.4015	6.384
	130	.011	.909	.001			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)
See table 2.3 for proxy definitions.

Table 2.11: Multivariate tests of hypotheses H3b to H7b: evidence on the variation in dividend response coefficients, when dividends announced second

$$\text{Response coefficient} = b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta}$$
$$+\ b_3 * \text{Dividend growth rate} + b_4 * \text{Interest rate} + b_5 * \text{Tax rate dummy}$$

	Obs	b_0	b_1	b_2	b_3	b_4	b_5	Adjusted R^2	White's χ^2	Largest VIF
		Predicted:	−	−	+	−	+			
		Hypotheses:	H3b	H4b	H5b	H6b	H7b			
1	All	-450.340	9.263	7.493	440.442			.0018	.0000	1.673
	675	.069	.668	.740	.031					
2	All	-397.337	10.973	8.126	414.727	-2.542		.0050	.0000	1.676
	675	.110	.697	.758	.039	.038				
3	All	-752.261	4.688	2.129	512.876	0.148	2.804	.0035	.0012	5.003
	415	.131	.566	.553	.049	.516	.230			
4	Pos	-947.036	-40.272	1.264	998.053			.0653	.0076	1.707
	367	.001	.062	.534	.000					
5	Pos	-745.352	-35.673	2.716	876.869	-7.384		.1091	.0112	1.710
	367	.011	.082	.576	.001	.000				
6	Pos	-1581.176	-24.846	3.964	918.310	0.188	8.384	.1043	.0886	5.223
	229	.012	.238	.578	.008	.516	.040			
7	Log	3.373	-2.028	-0.356	23.441			.1085	.4692	1.724
	367	.000	.004	.033	.000					
8	Log	7.010	-1.919	-0.363	20.964	-1.524		.1499	.3960	1.726
	367	.000	.006	.028	.000	.000				
9	Log	-20.733	-2.182	-0.446	15.844	0.890	0.263	.1909	.3226	6.003
	229	.030	.010	.036	.009	.830	.002			
When data restricted to announcements being within two weeks of each other										
10	All	-589.022	8.242	-5.469	587.143			.0000	.0243	1.567
	405	.126	.612	.371	.056					
11	All	-532.222	9.360	-3.798	554.101	-2.288		.0008	.0353	1.569
	405	.169	.626	.410	.077	.121				
12	All	-1279.771	3.978	-3.486	803.600	2.977	5.256	.0000	.0937	5.411
	243	.091	.539	.439	.056	.711	.171			
13	Pos	-926.822	-37.443	-14.843	990.854			.0265	.1968	1.702
	216	.068	.172	.246	.021					
14	Pos	-625.606	-32.178	-9.009	792.114	-9.639		.0910	.1028	1.704
	216	.206	.200	.333	.047	.000				
15	Pos	-1896.109	-27.802	-8.574	982.939	0.846	11.423	.0870	.5638	5.722
	130	.065	.316	.392	.080	.546	.064			
16	Log	3.422	-1.848	-0.424	18.784			.0527	.7331	1.704
	216	.000	.038	.050	.014					
17	Log	7.676	-1.736	-0.376	15.233	-1.772		.1151	.6042	1.706
	216	.000	.043	.066	.034	.000				
18	Log	-29.361	-2.366	-0.450	9.928	1.568	0.349	.1883	.3224	6.452
	130	.020	.033	.074	.170	.900	.001			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)
See table 2.3 for proxy definitions.

Table 2.12: Regression test of hypotheses H6c and H7c: evidence on the time series variation in earnings response coefficients, when earnings announced first

$$\text{Response coefficient} = b_0 + b_1 * \text{Interest rate} + b_2 * \text{Tax rate dummy}$$

	Obs	b_0	b_1	b_2	Adjusted	White's	Largest
		Predicted:	–	+	R^2	χ^2	VIF
		Hypotheses:	H6c	H7c			
1	All	4.186	-0.220		.0000	.1009	
	3321	.294	.267				
2	All	-164.454	1.434	1.790	.0006	.1078	5.011
	1962	.087	.926	.040			
3	Pos	32.636	-1.693		.0057	.1009	
	1839	.000	.000				
4	Pos	-339.517	1.751	3.980	.0102	.0656	4.904
	1087	.017	.887	.004			
5	Log	2.341	-0.516		.0025	.0000	
	1839	.000	.009				
6	Log	-18.990	1.266	0.202	.0162	.0003	5.708
	1087	.002	.984	.000			
When data restricted to announcements being within two weeks of each other							
7	All	6.746	-0.364		.0000	.1496	
	2042	.177	.204				
8	All	-172.033	1.427	1.894	.0003	.2360	4.962
	1203	.154	.872	.070			
9	Pos	35.613	-1.890		.0061	.2161	
	1125	.000	.002				
10	Pos	-329.353	1.486	3.902	.0093	.1981	4.872
	666	.082	.778	.027			
11	Log	1.846	-0.304		.0001	.0000	
	1125	.007	.143				
12	Log	-19.714	1.458	0.204	.0120	.0001	5.624
	666	.013	.971	.003			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)
See table 2.3 for proxy definitions.

Table 2.13: Multivariate test of hypotheses H3c to H7c: evidence on the variation in earnings response coefficients, when earnings announced first

$$\text{Response coefficient} = b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta}$$
$$+ \; b_3 * \text{Dividend growth rate} + b_4 * \text{Interest rate} + b_5 * \text{Tax rate dummy}$$

	Obs	b_0	b_1	b_2	b_3	b_4	b_5	Adjusted R^2	White's χ^2	Largest VIF
		Predicted:	–	–	+	–	+			
		Hypotheses:	H3c	H4c	H5c	H6c	H7c			
1	All	-49.414	0.076	0.734	49.721			.0000	.0779	1.024
	3321	.343	.556	.614	.166					
2	All	-47.028	0.070	0.707	49.784	-0.219		.0000	.0903	1.024
	3321	.368	.551	.610	.166	.268				
3	All	-250.103	0.147	3.659	81.383	1.437	1.784	.0001	.2953	5.012
	1962	.044	.564	.831	.144	.926	.041			
4	Pos	-334.859	-0.183	2.956	341.027			.0108	.1591	1.333
	1834	.000	.487	.781	.000					
5	Pos	-311.009	0.066	2.919	335.121	-1.609		.0159	.3572	1.333
	1834	.000	.504	.779	.000	.001				
6	Pos	-644.159	0.386	5.871	299.833	1.780	3.913	.0144	.7274	4.918
	1085	.000	.518	.832	.008	.891	.004			
7	Log	0.426	0.419	0.253	39.247			.0898	.5370	1.148
	1834	.000	.968	.994	.000					
8	Log	1.409	0.422	0.252	39.076	-0.410		.0912	.0168	1.148
	1834	.006	.969	.994	.000	.026				
9	Log	-18.581	0.582	0.373	38.030	1.246	0.190	.0965	.0381	5.714
	1085	.001	.984	.997	.000	.987	.000			
When data restricted to announcements being within two weeks of each other										
10	All	-95.699	0.223	2.363	94.657			.0000	.0097	1.022
	2042	.168	.584	.764	.083					
11	All	-91.714	0.247	2.391	94.730	-0.370		.0000	.0271	1.023
	2042	.187	.593	.767	.083	.202				
12	All	-253.546	0.387	5.347	71.938	1.450	1.929	.0000	.5320	4.974
	1203	.113	.601	.858	.241	.876	.067			
13	Pos	-309.843	-0.654	3.387	316.733			.0061	.1835	1.274
	1125	.008	.463	.739	.003					
14	Pos	-282.564	-0.113	3.761	309.348	-1.824		.0117	.3615	1.276
	1125	.016	.494	.762	.003	.003				
15	Pos	-543.394	1.159	8.850	208.634	1.461	3.826	.0089	.8432	4.897
	666	.034	.544	.857	.117	.774	.029			
16	Log	0.328	0.598	0.270	40.337			.0790	.8879	1.098
	1125	.017	.989	.971	.000					
17	Log	0.884	0.603	0.274	40.226	-0.232		.0788	.1596	1.098
	1125	.188	.989	.973	.000	.199				
18	Log	-18.124	0.719	0.342	36.771	1.311	0.181	.0754	.0289	5.646
	666	.018	.992	.957	.000	.961	.006			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)
See table 2.3 for proxy definitions.

Chapter 3

VARIATION IN THE ANNUAL DIVIDEND RESPONSE COEFFICIENT

3.1 Introduction

Collins and Kothari (1989) show that the earnings response coefficient, the relation between firm value and earnings, is not a constant. The earnings response coefficient is larger for firms whose earnings are more persistent, for firms which are less risky, and for firms whose earnings exhibit higher growth. This paper examines the dividend response coefficient, the relation between firm value and dividends. It shows that this relation is also not constant. The dividend response coefficient is larger for firms with lower dividend payout rates, for firms which are less risky, and for firms whose dividends exhibit higher growth.

Dividend changes transmit to the market changes in management's expectations about future cash flows. But payment of dividends imposes a tax cost on most recipients. Thus the sign of the dividend response coefficient varies depending on what other sources of information the market is assumed to have about future cash flows. The paper provides some empirical support for the proposition (Modigliani, 1982) that, if dividends do not provide information about future cash flows, then their tax cost should imply an inverse relation between firm value and dividends.

These results make a significant contribution to accounting research for two reasons. First, they respond to Brennan's (1991) call for accounting research to consider dividends in addition to accounting numbers in studies of changes in firm value. Second, they show that the dividend response coefficient exhibits much the same cross-sectional variation as the earnings response coefficient. This similarity supports the view that earnings and dividends provide similar information about future cash flows which is used in determining firm value.[1] It also suggests that cross sectional estima-

[1] See chapter 1 of the dissertation for a model of firm value based on both dividends and accounting numbers. Miller and Rock's (1985) model of firm value also uses earnings and dividends.

tion of dividend response coefficients using regression techniques may underestimate the size of the dividend response coefficient.[2]

The remainder of the paper is organized as follows. The following section develops the hypotheses. Then the proxies for the conceptual constructs are discussed and the statistical procedures are outlined. Finally the results are presented and conclusions drawn.

3.2 Development of hypotheses

This section develops hypotheses concerning the relation between (changes in) firm value and (changes in) dividends, and how that relation varies across firms.

3.2.1 Firm value as a function of dividends

Linter (1956) argues that firms change their dividends only in response to a persistent change in their earnings. If a firm maintains a constant dividend payout rate, then a 10% increase in dividends signals a persistent 10% increase in earnings which should indicate a 10% increase in firm value.

Although dividends provide information about earnings persistence, the payment of dividends imposes a cost on each shareholder equal to the difference (if any) between the tax on the dividends and the present value of the capital gains tax that the shareholder would pay when the gain in firm value would otherwise have been converted to cash. Although this difference may be nil for some shareholders (i.e. those not subject to tax or those who can effectively shelter all dividend income) or even negative for some corporate shareholders who pay little tax on dividend income, studies such as Elton and Gruber (1970) suggest that the difference is positive for most firms' shareholders. Shleifer and Vishny (1986) argue that each firm selects an optimum dividend payout rate by trading off the tax cost of the dividend to the individual shareholders[3] against the gain from the increased monitoring that dividends

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[2] This econometric issue is discussed in chapter 2 of the dissertation.

[3] According to Biddle, Johnson, and Resler (1992, Table 1): prior to 1986, realized capital gains were taxed at 60% of dividends (ignoring the $200 dividend exemption); dividends were taxed at 70% in 1979 and 1980, 50% in 1981-85. In 1986 and 1987 dividends and realized capital gains were taxed at the same rate: 50% in 1986 and 38.5% in 1987.

encourage. If there are no gains to monitoring, then the optimum dividend payout rate is zero.

Consider a firm investing only in assets which produce cash flows which are proportional to the level of investment; for example, purchasing treasury bills or investing in IBM stock, both of which produce cash flows proportional to the amount invested. The value of a firm investing in such *financial* assets equals the expected present value of its future cash flows. Since most financial assets are publicly traded, arbitrage implies that the value of a firm investing in such financial assets only equals the sum of the market values of the financial assets. There are no gains to monitoring a firm investing in financial assets assuming the individual firm is a price taker in the market for financial assets and there are constant returns to investment in financial assets. Accordingly the optimum dividend payout rate for a firm investing in financial assets only is zero.

Most firms also invest in assets which produce cash flows which exhibit diminishing marginal returns; each extra dollar invested produces a smaller extra dollar of cash flow than the preceding dollar did. The value of a firm investing in such *real* assets equals the expected present value of its future cash flows. A firm would not invest in real assets if the present value of the resulting future cash flows were less than their market values. Indeed, the firm would maximize its value if the marginal cost of the last unit of real assets acquired equalled the marginal increase in the present value of the future cash flows. But under the assumption of diminishing marginal returns, this implies that the average cost of the real assets must be less than the average return on the assets, so that firm value exceeds the market value of its assets. The selection of the optimum level of investment in real assets is not a trivial decision; shareholders may be willing to incur some monitoring expenses in order to ensure that the decision is made as effectively as possible. Therefore the optimal dividend payout rate on the persistent cash flows resulting from investment in real assets may be greater than zero.

Thus firm value can be expressed in four ways. Firstly, it is the present value of the expected future cash flows from investing in financial and real assets, less the present value of the tax cost of future dividends. Secondly, since the present value of the expected future cash flows from investing in financial assets equals their market value, firm value equals the market value of the holdings of financial assets plus the present value of the expected future cash flows from investing in real assets minus the present value of the tax cost of future dividends. Thirdly, since dividends are proportional to persistent cash flows from investing in real assets, firm value equals the market value of its holdings of financial assets plus the present value of the expected future dividends divided by the payout rate, net of the tax cost of the dividends. Fourthly, if persistent *operating cash flows* (i.e. cash flows from investing in real assets) and dividends are expected to grow (or diminish) at a constant rate, then firm value equals the market value of its holdings of financial assets plus a term proportional to current dividends. This term, the dividend response coefficient, should be greater than one, since it equals the present value of all future dividends, net of their tax cost.[4]

The first two hypotheses are then

> H1: Firm value equals the present value of expected future operating cash flow plus the market value of financial assets less a fraction (being the effective tax cost rate) of the present value of expected future dividends.
>
> H2: Firm value equals the market value of financial assets plus a multiple (greater than 1) of the current dividend.

3.2.2 Variation in the dividend response coefficient

The multiple referred to in hypothesis 2, the dividend response coefficient, varies across firms. A given increase in future cash flows will occasion a larger increase in dividends, the larger is the dividend payout rate. Thus the larger the payout rate, the lower is the expected increase in each future period's operating cash flows indicated by a given increase in current dividends.[5]

[4] The above conclusions are justified more rigorously in chapter 1 of the dissertation.

[5] The effect on firm value of changes in dividends and dividend payout rates is discussed in more detail in the appendix to chapter 1 of the dissertation. Miller and Scholes (1978) argues that investors can effectively shelter their dividend income from taxes by leveraging their stock purchases. If their proposition is correct, then the dividend payout rate should not affect the response coefficients. Brennan (1991, p. 75) appears to argue that a higher dividend payout rate could lead to a larger earnings response coefficient, since it would imply that future dividend distributions would be higher which would increase firm value. Shefrin and Statman (1984) argues that share-

H3: The dividend response coefficient is smaller for firms with a larger dividend payout rate.

The larger the discount rate, the lower the present value of the indicated increase in future operating cash flows, and so the smaller the increase in firm value. Firms with higher systematic risk have larger discount rates.

H4: The dividend response coefficient is smaller the larger the firm's systematic risk.[6]

The higher the growth rate, the greater is the effect on future operating cash flows of the increase in this period's persistent operating cash flows indicated by the unexpected increase in dividends, and so the greater is the increase in firm value.

H5: The dividend response coefficient is larger the larger the firm's growth rate.

3.2.3 Change in firm value as a function of changes in dividends

Previous studies of the relation between firm value and dividends have used various specifications of the relation. For instance, Easton (1985, Table 3a) regressed the 1962 *values* of 349 firms on the *level* of their 1962 dividends and found a marginally

holders prefer to receive dividends rather than sell part of their shareholdings when they need cash because they might subsequently regret reducing their proportionate ownership of the firm. If their proposition is correct, then the response coefficients will be larger for firms with larger payout rates. Jensen (1986) argued that corporate managers invest cash in excess of that needed for operations suboptimally, so that too low a payout rate may dampen response coefficients. On the other hand, to the extent that a firm uses its cash to pay dividends, it has less cash available to invest. In addition to the costs of raising additional equity, such as those arising from the preparation of a prospectus and from underwriter fees and commissions, Myers and Majluf (1984) argues that management may decline to undertake projects with positive net present value rather than issue share at less than what they believe to be the true firm value. This argument suggests that too high a payout rate may lower the response coefficients. If the payout rate is set optimally to trade-off all the costs of issuing dividends against the benefits, as suggested by Shleifer and Vishny (1986), Rozeff (1982) and others, then a higher payout rate suggests that a firm faces higher agency and monitoring costs implying that it will have lower response coefficients.

[6] As Collins and Kothari (1989) note, the discount rate also varies over time with the risk free rate. See the appendix for further discussion.

significantly positive dividend response coefficient. Livnat and Zarowin (1990) on the other hand regressed abnormal *returns* on *changes* in dividends (and other cash flow variables) and found a significantly positive dividend response coefficient. Many other studies have regressed *changes* in firm value on *levels* of dividends (or dividend *yields*) and found positive dividend response coefficients. See chapter 16 of Brealey and Myers (1988) or Litzenberger and Ramaswamy (1982) for brief surveys of this literature.

For comparability with some of these previous studies, this paper also examines the relation between *returns* and *changes* in dividends. If all changes in operating cash flow are persistent then the change in firm value should be a multiple of either the change in operating cash flow or the change in dividends. To the extent any change in operating cash flow is transitory, changes in dividends and changes in operating cash flow are not exact substitutes.

> H6: Cum dividend change in firm value equals nonoperating (financial) income plus operating cash flow plus a multiple (greater than 1) of the change in dividends.

The dividend response coefficient determined here is predicted to vary across firms in a similar manner to that in hypothesis 2.

> H7: The dividend response coefficient is smaller for firms with a larger dividend payout rate.

> H8: The dividend response coefficient is smaller the larger the firm's systematic risk.

> H9: The dividend response coefficient is larger the larger the firm's growth rate.

3.3 Proxies and sample

This section discusses the proxies used for the constructs in the hypotheses and the sample used to test the hypotheses. For ease of exposition, the proxies for hypotheses H2 and H6 are addressed first, followed by the proxies for hypothesis H1 and for the firm specific rates in hypotheses H3, H4, H5, H7, H8, and H9. The sample selection criteria are discussed concurrently with the proxy discussion. Table 3.1 summarizes the sample selection criteria. Table 3.2 shows the distribution of the 249 sample firms that met all criteria across industries. Note that 39 firms in the sample are from the transportation, public utilities, finance, insurance and real estate industries. These industries are sometimes excluded from studies of firm value.

3.3.1 Firm value as a function of dividends: hypothesis H2

Hypothesis H2 predicts that the relation between firm value V_t, financial assets C_t, and dividends D_t will be of the following form:

$$V_t = \alpha_0 + \alpha_1 C_t + \alpha_2 D_t$$

where predictions for the intercept and coefficients are

$$\begin{aligned} \alpha_0 &= 0 \\ \alpha_1 &= 1 \\ \alpha_2 &> 1. \end{aligned}$$

The hypothesis requires proxies for firm value, financial assets, and dividends, and the determination of suitable time periods. Since more detail is available on the breakdown of total assets on the annual tape than on the quarterly tape, the sample consists of firms listed on both the Compustat annual industrial database and the CRSP monthly NYSE database with December yearends[7] which met certain criteria. Since significant accounting policy changes took place in 1988 (in particular the requirement to consolidate financial subsidiaries which caused significant increases in reported cash and investments for many firms), it would be undesirable to add data from this year to data from previous years. Thus the most recent comparable eight years are 1980 to 1987.

The market value of common stock proxies for firm value V_t in the tests that follow since the model is framed in terms of the residual owners of the firm and the data

[7] This permits meaningful reporting of the results on a year by year basis. If the response coefficients vary over time due to changes in risk free rates or in effective tax rates on dividends, then regression coefficients based on data in which firm values and dividends are measured at different points in time will be biased towards zero.

are readily available. Firms which did not have yearend common stock prices on the CRSP database were eliminated from the sample.

Financial assets C_t are those which produce cash flows which are proportional to the level of investment. Cash and marketable securities meet this definition, while inventory and capital assets (property, plant, and equipment and most intangibles) do not. Other monetary assets are difficult to classify. A reasonable level of receivables probably exhibits constant returns, but excessive holdings of receivables likely exhibit reduced returns. In addition, for most companies, receivables are more closely associated with their operating activities than their financing or investing activities. No combination of published balance sheet items provides an exact proxy for the market value of financial (nonoperating) assets. In the tests that follow, cash and short-term and long-term investments[8] proxy for financial (nonoperating) assets. Firms were eliminated from the sample if they did not disclose cash and short term investments.

Since the market value of common shares was selected to proxy for firm value, common share dividends were selected to proxy for dividends D_t. Most dividends are paid in cash and are fully taxable; in order to ensure similar proxies for all firms, firms that paid dividends that were not taxable (e.g. dividends that represented a refund of invested capital) were excluded from the sample.

The model predicts that firms pay dividends at the end of each period based on management's expectation of future cash flows. The model's interpretation of observing a zero dividend is that it proxies for a negative (or zero) level of expected

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[8] Compustat defines these items as follows:

D1 Cash and short-term investments "represents cash and all securities readily transferable to cash as listed in the current assets section. ... This item excludes: ... short term investments at equity."

D31 Investments and advances-equity method "represents long term investments and advances to unconsolidated subsidiaries and affiliates in which the parent has significant control, as stated in the consolidated financial statements. "

D32 Investments and advances - other "represents long-term receivables and other investments, and advances including investments in unconsolidated companies in which there is no control. This item includes: all investments carried at cost, ..., direct financing leases when the company is the lessor, ..., land held for resale, ..., marketable securities, ..., sales type leases when the company is the lessor, ..."

future operating cash flows. Since this proxy introduces considerable error in the measurement of dividends, firms were removed from the sample if they did not declare at least one cash dividend per year.

The CRSP tape provides common stock prices, the proxy for firm value, at the end of each month. It also provides the announcement date and payment date of common share dividends. The Compustat tape provides the yearend amount of cash and investments, the proxy for financial assets, and the announcement date for earnings. The model assumes that the three constructs are measured and announced simultaneously. Since this never happens in reality to the proxies, some rule is required as to how to relate them. In this study, the common share prices and cash and investments are measured at the fiscal yearend (December 31).[9] Dividends are those announced after the ninth week of the year and before the tenth week of the following year (i.e. March 5 of the year to March 4 of the following year).

Substituting the proxies into the regressions gives for hypothesis 2:

$$CSV_t = a_0 + a_1 CI_t + a_2 DIV_t + e_t \tag{3.1}$$

where
CSV_t is the market value of the firm's common shares at the end of period t,
CI_t is the firm's cash and investments at the end of period t,
DIV_t is the firm's common share dividends for period t, and
e_t is the residual term with mean zero.

To reduce possible heteroscedasticity, all variables in the regression were scaled by the number of common shares outstanding used in the calculation of primary earnings per share. Firms were eliminated from the sample if they did not disclose the number of shares used to calculate primary earnings per share. The proxies are summarized in table 3.3.

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[9] The appendix reports the results of measuring common share prices two months into the new year, i.e. at February 28.

3.3.2 Returns as a function of change in dividends: hypothesis H6

Hypothesis H6 predicts that the relation between change in firm value, financial assets[10] C, nonoperating cash flow Y, and change in dividends will be of the following form:

$$V_t + D_t - V_{t-1} = c_0 + c_1 C_{t-1} + c_2 Y_t + c_3[D_t - D_{t-1}]$$

where predictions for the intercept and coefficients are

$$\begin{aligned} c_0 &= 0 \\ c_1 &< 1 \\ c_2 &= 1 \\ c_3 &> 1. \end{aligned}$$

Operating cash flow Y_t equals the cash from sale of the outputs for the current period less the cash applied to the purchase of the inputs (real assets) for the following period.[11] A possible way to develop a proxy for it would be to begin with net income and delete nonoperating items and all accruals. Since most of the differences between operating income and net income relate to nonoperating items or accruals, it seemed more appropriate to begin with operating income. Operating income was converted to operating cash flow by subtracting the increase in current assets other than cash and short-term investments, by adding the increase in current liabilities other than debt and income taxes payable, by subtracting purchases of property, plant, and equipment, and by adding the proceeds of sales of property, plant, and equipment.[12]

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[10] Since financial assets and financial income are expected to be linearly related, either can be used in the equation. Using financial income would imply a slope coefficient of +1; using financial assets implies a slope coefficient c_1 equal to the rate of return on the financial assets.

[11] Recall that operating cash flow is defined in the hypotheses as the periodic cash flow from investing in real assets. It is not the same amount as is normally reported on the Cash Flow Statement as Cash from Operations. The latter amount includes cash flow from investing in financial assets and excludes cash flow from the sale or purchase of real assets.

[12] Compustat defines these items as follows:

D128 Capital expenditures "represents cash outflow or funds used for additions to the company's property, plant and equipment. This item includes: expenditures for capital leases, Firms were excluded from the sample if they did not disclose sufficient information to calculate operating cash flow.[13]

The proxies for firm value V_t, financial assets C_t, and dividends D_t are the same as those for hypothesis H2.[14] [15]

Substituting the proxies into the regressions gives for hypothesis 6:

$$RET_t = b_0 + b_1 CI_{t-1} + b_2 OCF_t + b_3 DIVCHG_t + e_t \quad (3.2)$$

increases in funds for construction, and reclassification of inventory to property, plant, and equipment."

D107 Sale of property, plant, and equipment "represents funds received or cash inflows from the sale of property, plant, and equipment."

[13] Specifically, firms were eliminated if Compustat did not report their operating income before depreciation, current assets, accounts payable, and other current liabilities.

[14] As discussed in the preceding subsection, in the model most variables are measured and announced instantaneously at the end of the year, including the output for the period just completed, the determination of the optimal input for the following period, the determination of the dividend to be paid, the announcement of the dividend, the stock going ex dividend, the determination of the amount of nonoperating assets, and the determination of firm value. In reality several weeks may elapse between the occurrence of the first and last of these events, and they may not happen in the order given above. The proxy for nonoperating assets is the cash and investments reported in the yearend balance sheet, even though the amounts may not be disclosed until several weeks after the yearend. The proxy for dividends is the dividends announced beginning ten weeks after the year starts and ending nine weeks after it ends. The proxy for change in firm value is the cum dividend change in firm value over the twelve months that constitute the firm's fiscal year. This proxy corresponds to the model's instantaneous determination of firm value at the end of the period. It assumes that the market forms an unbiased estimate of the yearend nonoperating assets and the year's dividends, even though these amounts may not have been announced yet. An alternate proxy for change in firm value is the cum dividend change in firm value over the twelve months from month 3 (March) to month 14 (the following February). It assumes that all information relating to the year will be released within two months of the yearend, and that no contaminating information related to the following year will yet have been revealed. The appendix reports the results of measuring common share prices using this alternate proxy.

[15] The model would permit the terms for nonoperating assets and operating cash flows to be replaced by cash flow from both the operating and nonoperating segments of the firm, with a predicted regression coefficient of one. A proxy for this construct would be primary earnings per share including extraordinary items (which is calculated after deducting preferred dividends) less the increase in non-cash net assets (i.e. total assets less accounts and taxes payable and other non-debt current liabilities) per share.

where

RET_t is the cum dividend return on the firm's common shares over the period,

CI_{t-1} is the firm's cash and investments at the beginning of the period,

OCF_t is the firm's operating cash flow over the period,

$DIVCHG_t$ is the increase in the firm's common share dividends for the period over those for the preceding period, and

e_t is the residual term with mean zero.

As recommended by Christie (1987), the variables in the regression for hypothesis H6 were scaled by the firm's opening market value to reduce possible problems with heteroscedasticity. Adjustments were made for post 1979 stock splits and dividends. The proxies are summarized in table 3.4.

3.3.3 Firm value as a function of expected cash flows and dividends: hypothesis H1

Hypothesis H1 predicts that the relation between firm value V_t, financial assets C_t, the present value of future operating cash flows EY_t, the present value of future dividends ED_t, will be of the following form:

$$V_t = \gamma_0 + \gamma_1 C_t + \gamma_2 EY_t + \gamma_3 ED_t$$

where predictions for the intercept and coefficients are

$$\begin{aligned} \gamma_0 &= 0 \\ \gamma_1 &= 1 \\ \gamma_2 &= 1 \\ \gamma_3 &= -T \end{aligned}$$

where T is the effective tax rate on dividends.

The proxies for firm value V_t and financial assets C_t are the same as for the previous hypotheses. If expectations are formed rationally, so that on average future amounts equal their expected value, then possible proxies for expected future cash flows and dividends are the actual cash flows and dividends in a limited number of future periods. The more periods used, the better the proxies should be for two reasons. First, actual cash flow will differ from expected cash flow in each period, but if the differences are random and independent, then the law of large numbers suggests that the difference between actual and expected cash flow should decrease as more periods are used. Second, the constructs are expected discounted cash flows and dividends for *all* future periods, so that the more periods used, the closer the proxies will be.

Substituting the proxies into the regressions gives for hypothesis 1:

$$CSV_t = a_0 + a_1 CI_t + a_2 OCFn_t + a_3 DIVn_t + e_t \tag{3.3}$$

where

CSV_t is the market value of the firm's common shares at the end of period t,

CI_t is the firm's cash and investments at the end of period t,

$OCFn_t$ is the firm's operating cash flow starting in period t+1 and lasting for n periods,

$DIVn_t$ is the firm's common share dividends starting in period t+1 and lasting for n periods,

and e_t is the residual term with mean zero.

To reduce possible heteroscedasticity, all variables in the regression are scaled by the number of common shares outstanding used in the calculation of primary earnings per share. The proxies are summarized in table 3.5.

3.3.4 Cross sectional variation in the response coefficients

Hypothesis H3, H4, H5, H7, H8, and H9 predict that the response coefficient DRC should be a function of the dividend payout rate d, systematic risk r, and the growth rate g:

$$DRC = \phi(d, r, g)$$

with the response coefficient increasing when the payout rate decreases, the risk decreases, or the growth rate increases.

A proxy for the payout rate d could be calculated for each firm-year by dividing the dividends for that year by the operating cash flow for the year. However if dividends are not adjusted for transitory shocks,[16] then such a calculation would introduce considerable error in the proxy. Instead a proxy for each firm's payout rate (for all

[16] As suggested by Lintner (1956) and the model in chapter 1 of the dissertation.

years) was calculated by dividing the total dividends paid over the eight years 1980 to 1987 by the total operating cash flow for the eight years.

Each firm's beta, calculated by regressing its monthly returns over the full eight years against equal weighted monthly market returns, proxied for its systematic risk r.

Each firm's growth rate g was estimated by regressing the log of dividends on the calendar year.[17]

To test hypothesis 3, 4, 5, 7, 8, and 9 the regression equations are:[18]

$$\begin{aligned} DRC &= b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} \\ &+ b_3 * \text{Dividend growth rate} + e \end{aligned} \tag{3.4}$$

where e is the residual term with mean zero. The proxies are summarized in table 3.6.

3.4 *Statistical procedures*

The equations were tested using ordinary least squares. Significance of the parameter estimates was tested using standard student t tests. Variance inflation factors and the significance level of White's test for homoscedasticity are also reported.

Variance inflation factors measure how much the variance of the estimated regression coefficients are inflated in comparison to when the independent variables are not related. A rule of thumb which is commonly used is that if the largest variance inflation factor exceeds ten, then multicollinearity may be unduly influencing the regression estimates. The presence of multicollinearity tends to lead to improperly rejecting the null hypothesis, and so lowers the power of the tests.

White's statistic tests the joint hypotheses that the empirical model is correctly specified and that the errors are homoscedastic. If the statistic is significant, then one of these two hypotheses can be rejected.

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[17] The appendix reports the results when the alternate proxy, the percentage change in operating cash flow, was used in the regressions.

[18] The equation is a Taylor series approximation to the relation derived in chapter 1 of the dissertation.

3.5 Results

Table 3.7 provides descriptive statistics for the 1743 observations (249 firms times 7 years) in the sample. The median price of the firms' common shares is \$48.00, the mean is \$57.74. The 249 firms experienced a 16% annual return on average during 1981 to 1987, though the lowest quartile of firm-years experienced price declines. Cash and investments were 13% of firm value at the median, being \$6.57 per share, while operating cash flow was 12% of firm value. On average dividends increased by 0.2% of firm value annually, though the lowest quartile of firm-years experienced either no change or a reduction in dividends. At the median dividends were \$1.76 per share.

3.5.1 Tests of hypothesis H1

Table 3.8 shows the results of regressing the proxies for firm value on those for non-operating assets, expected operating cash flow, and expected dividend tax costs. White's χ^2 statistic suggests that either the regression is misspecified or that the residual term is heteroscedastic. However it should be noted that with a sample size of 249, it takes only small departures from linearity of the relation among the variables or homoscedasticity of the residual term to produce a significant value for χ^2.

The variance inflation factors indicate that multicollinearity is not a significant factor. The R^2 indicate that the independent variables explain about a third of the cross-sectional variation in share prices.

The intercepts are significantly positive in all years, and are generally bigger the fewer years that the proxies for operating cash flows and dividend tax costs are summed over. The regression coefficient for nonoperating assets is significantly positive and generally insignificantly different from +1, consistent with hypothesis H1. The regression coefficient for operating cash flows is significantly positive, but is generally significantly less than +1. The regression coefficient for dividends is significantly positive contrary to the model's predictions.

Table 3.9 reports the results of repeating the regression with the intercept constrained to be zero. As would be expected, this increases the other coefficients. The comments made on the preceding table apply, except that the coefficient on nonoperating assets is now significantly greater than one, contrary to the model's predictions.

In summary, the regressions provide limited support for hypothesis H1. The regression coefficient on nonoperating assets is somewhat lower than the predicted value of +1 when the intercept is included in the regressions, and generally larger than +1 when the intercept is suppressed. The regression coefficients on expected dividend tax costs are positive contrary to prediction. However, the coefficients are smaller the more years used in the proxy, so that possibly if even more years had been used, the coefficients would become negative as predicted. The regression coefficients on expected operating cash flow are significantly positive as predicted, but generally less than +1, perhaps due to the failure to use a sufficient number of years' results in the proxy or to the failure to reduce the proxy by interest and tax costs.

The hypotheses were developed without considering debt and taxes.[19] Debt and preferred shares could have been included in the proxy for firm value or the proxy for nonoperating assets, or payments to debt and preferred stock holders could have been included in the proxy for operating cash flows. Perfect proxies might require classifying different portions of debt and preferred stock as part of each of these constructs. To the extent that debt and preferred shares (or payments to their holders) should have been included in the proxies for financial assets or operating cash flow, there is an error in variables problem which will bias their regression coefficients to zero. However, unless the inclusion was done correctly, which is practically impossible, there would still be an error in variables problem which could be as serious as the exclusion. Since the cost of attempting to adjust the proxies for these sources of financing is clear, but the benefits are nebulous, they were excluded from all the proxies.

A better proxy for operating cash flow would adjust for applicable income taxes. In fact, income tax is levied on income for tax purposes and firms report income tax expense on net income. Three possible proxies for income tax on operating cash flow suggest themselves. One is to apply the U.S. statutory income tax rate (on income over \$100,000) of 46% (40% in 1987). This rate understates the true tax rate to the extent that firms pay taxes in other jurisdictions (domestic or international) for which they are not permitted a full offset against U.S. federal taxes. It also understates the true tax rate to the extent that purchases less sales of real assets

[19] Consistent with the model in chapter 1 of the dissertation.

exceeds the depreciation permitted for tax purposes on real assets.

A second possible proxy is to apply the tax rate computed by dividing income tax expense by net income before taxes. This rate understates the true rate on operating cash flow to the extent it includes lower tax rates on nonoperating items such as intercorporate dividends, interest on tax-exempt municipal bonds, and capital gains.

The third option is to assume a tax rate of zero. Clearly this understates the true tax rate. If the true tax rate for all firms is 46%, then using a zero tax rate understates the regression coefficient on operating cash flows by 46%. If the true tax rate is not the same for all firms, then applying a zero tax rate produces a (measurement) error in variables problem which biases the regression coefficient towards zero. Since all three options likely produce some (measurement) error in variables problems and it is not clear which produces the least amount of error, the method which was simplest computationally was adopted, namely applying a zero tax rate.

Thus the low estimated coefficient on operating cash flow may be due to measurement error. In particular, ignoring debt and taxes causes the proxy to be overstated and the regression coefficient to be understated. The measurement error may also bias the intercept away from zero, and have an undetermined effect on the other two regression coefficients.

Few other studies have examined the relation between firm value and both dividends and financial statement amounts. Easton (1985, table 3b) obtained a positive coefficient on earnings and a negative coefficient on dividends when he regressed the 1962 values of 349 firms on their 1962 dividends and earnings. However, he indicated that the negative response coefficient was not obtained in all variations of the regression.

The hypothesis development section indicated that there is an optimum value for the dividend payout rate that maximizes the trade-off between the tax cost of the dividends and the gain to monitoring. This suggests that firm value is therefore a concave function of the dividend payout rate.[20] When the proxies for expected operating cash flows and expected dividends use only a few future periods, it may be that they also proxy for the dividend payout rate. Therefore regressions which

[20] This is just a restatement of the standard first and second order conditions for a local maximum, namely that the second derivative of firm value with respect to the payout rate be negative and the first derivative be positive.

include proxies for the dividend payout rate d and its square may be better specified.

Tables 3.10 and 3.11 report the results of repeating the previous two regressions after adding the proxy for the payout rate. The adjusted R^2s are larger suggesting that adding this variable increases the explanatory power of the regression. The regression coefficient on the payout rate is significantly positive as predicted. Also as predicted, the regression coefficient on the dividend cost proxy is less significantly positive, and in the regression with the largest summation period, it is significantly negative and the intercept term is not significantly different from zero.

Tables 3.12 and 3.13 report the results of repeating the previous regressions after adding the proxy for the payout rate squared. There is little increase in the R^2s suggesting that the additional explanatory power of this variable is minimal. The larger variance inflation factors suggest that this is due to it being correlated with variables already in the regression. On the other hand, the increases in White's χ^2 statistics suggest that this regression is better specified than the previous one. The regression coefficient on the payout rate squared is in most cases significantly negative as predicted. The regression coefficient on the payout rate is in most cases significantly positive and about twice the absolute value of the coefficient on the payout rate as predicted. The intercept terms are generally not significantly different from zero as predicted, except in two of the shortest summation periods. The remaining regression coefficients have not changed substantially.

In summary, the regression coefficient on the proxy for nonoperating assets was significantly positive in every regression as predicted, but sometimes was significantly different from one, contrary to hypothesis H1. The regression coefficient on the proxy for operating cash flow was significantly positive in each regression as predicted by hypothesis H1. The regression coefficient on dividends was generally significantly positive contrary to hypothesis H1. However, it was generally less significantly positive as the number of years in the proxy increased, which suggests that the more positive coefficients were due to less appropriate proxies.[21] It was negative in over a third of the regressions in which the payout rate appeared. It was significantly negative as predicted in all four regressions in which the payout rate appeared and the dividends were summed over eight years. With one exception, the regression coefficient on the

[21] However, it is also less positive/more negative in years in which operating cash flow and dividends from 1986 and 1987 appeared.

payout rate was positive as predicted and the regression coefficient on the payout rate squared was negative as predicted.

The appendix reports the results of regressing equation 3.3 using 1984–88 data on a smaller sample of 56 firms. With firm value at March 31, 1984 as the dependent variable, the regression coefficient on cash and investments is not significantly different from one, the regression coefficient on operating income (not adjusted for income taxes) summed over five years is about 0.5, and the regression coefficient on dividends summed over five years is negative, though significantly so only when the payout rate is included in the regression. These results also support hypothesis H1.

3.5.2 Tests of hypothesis H2

Panel A of table 3.14 reports the results of regressing the proxy for firm value for all 1743 observations on the proxies for nonoperating assets and dividends. Although the small variance inflation factors suggest that multicollinearity is not a problem and the independent variables appear to explain about 15% of the variability in firm value, White's χ^2 statistic suggest that the model is either mispecified or that the residual terms are heteroscedastic. The coefficient on cash and investments is significantly greater than one, contrary to prediction, while the coefficient on dividends is not significantly greater than one, also contrary to prediction.

As proposed in hypotheses H3, H4, and H5, the dividend response coefficient a_2 varies across firms and through time. This instability in the theoretical slope coefficient biases the observed value for the response coefficient towards zero. As a partial control for the bias, the regressions are repeated on time series and cross sectional bases. In the time series regressions, the firm specific rates (payout, risk, and growth rates) are constant in each regression, so that the theoretical slope coefficients vary only due to economy wide factors such as the risk free interest rate and the effective tax rate on dividends. The range of variability in these rates is expected to be less than is the range of variability of the firm specific rates. In the cross sectional regressions, the economy wide factors are held constant, but the firm specific rates vary. Since the latter rates vary more than the former factors, the reduction in bias is less effective in the cross sectional regressions than in the time series ones.

The mean and medians of the 249 time series regressions are reported in Panel B of the table. Because some of the 249 firm regressions appeared to have correlated residual terms, the regressions were also rerun under the assumption that the residual term was AR(1), and the mean and median results of these regressions are reported.[22]

Panel C reports the results of the cross sectional regressions for each year from 1980 to 1986, and the mean and median parameter estimates for these years are also reported.

White's χ^2 statistic suggest that the cross sectional regressions are generally well specified and that the residual terms are homoscedastic. The small variance inflation factors suggest that multicollinearity is not a problem. The independent variables appear to explain about a quarter of the variability in firm value.

The coefficient on nonoperating assets is consistently positive and not significantly different from +1 in the time series regressions, consistent with hypothesis H2. On the other hand, the coefficient is marginally significantly less than +1 in the average cross sectional tests, and significantly greater than +1 in the pooled regression.

The coefficient on dividends is consistently positive and generally significantly greater than +1 consistent with hypothesis H2. The average results are much higher for the time series regressions than for the cross-sectional regressions, consistent with the effect of the bias due to the variability in the theoretical slope coefficient.

The intercept terms are generally significantly positive, contrary to the model's predictions.[23]

Since the model predicts that the intercept term should be zero, the regressions were repeated imposing this restriction. The results are reported in table 3.15. The χ^2 and variance inflation statistics are generally the same as in the previous table.

The coefficient on nonoperating assets is consistently positive and larger than when an intercept term was included. Hypothesis H2 that it equals +1 cannot be rejected except in the pooled regression and some of the individual cross sectional regressions. The coefficient on dividends is consistently significantly greater than +1 and is larger in the cross sectionally regressions but smaller in the time series regressions than that in the previous table.

In summary, the coefficient on nonoperating assets is significantly positive in all

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[22] The results of assuming the residual term is AR(1) are similar to assuming it has no autocorrelation.

[23] Again, the fact that the slope coefficients are biased towards zero may bias the intercept away from zero.

regressions, and is generally not significantly different from the predicted value of +1. The observed dividend response coefficient is significantly greater than one in almost all the regressions as predicted.

Previous studies have also generally observed a positive dividend response coefficient. Most of them have used different specifications of the relation between dividends and firm value, so that their observed magnitudes are not directly comparable to the regression coefficients obtained here.

3.5.3 Tests of hypotheses H3 to H5

Table 3.16 shows the descriptive statistics for the rates which are the independent variables in the regressions. The mean payout rate is 42%, slightly more than the median rate of 35%. The average of the 249 firms' betas is 1.0. The mean dividend growth rate of 5.6% is slightly smaller than the mean operating cash flow growth rate of 7.4%.

Table 3.17 reports the results of the cross-sectional regression (equation # 3.4) of the dividend response coefficients on the proxies for the payout rate, the risk rate, and the growth rate. The R^2 statistic suggest that the proxies explain about 15% of the variation in the dividend response coefficient.

The regression coefficient for the dividend payout rate is significantly negative as predicted by hypothesis H3. The coefficient for the firm's beta is positive contrary to hypothesis H4. The coefficient on the growth term is significantly positive, as predicted by hypothesis H5.

The appendix reports other tests of hypotheses H3, H4, and H5. All tests find a negative relation between the payout rate and the dividend response coefficient, as predicted by hypothesis H3, with one tail p-values between .003 and .177. The relation between beta and the response coefficient is positive, contrary to hypothesis H4, in other tests based on the estimates of the dividend response coefficient from table 3.15, but the relation is negative when the estimates are based on the estimates from table 3.14. The relation between growth and the dividend response coefficient is positive (though not always significantly so) as predicted in hypothesis H5 using either the dividend growth rate or the operating cash flow growth rate, with two exceptions.

3.5.4 Tests of hypothesis H6

Table 3.18 reports the results of regression 3.2 in which the calendar year returns were regressed on the proxies for nonoperating assets, operating cash flow, and change in dividends. Pooling all 1743 observations produces a slope coefficient on operating cash flow which is significantly positive as predicted, but significantly less than one, contrary to prediction, and insignificant regression coefficients on cash and investments and change in dividends, contrary to prediction. White's χ^2 statistic is significant, which indicates that the regression is misspecified, so that the results should be interpreted with caution.

Errors in variables problems may cause all coefficients in the pooled regression to be biased towards zero. Moreover, as proposed in hypotheses H7, H8, and H9, the dividend response coefficient b_3 varies across firms and through time. As discussed above, this instability in the theoretical slope coefficient also biases the observed value for the response coefficient towards zero. As a partial control for the latter problem, the regressions are repeated on time series and cross sectional bases.

The mean and medians of the 249 time series regressions are reported in the next six rows of the table. The average regression coefficient on cash and investments is significantly positive, but appears to be much larger than the predicted rate which should equal the discount rate of about 16%. The average regression coefficient on operating cash flow is not significantly different from +1, as predicted. The mean estimated dividend response coefficient is significantly greater than one as predicted, though the median is not.

Since there was some evidence that some of the preceding times series regressions had autocorrelated residual terms, they were repeated assuming the residual terms followed a first order autocorrelation pattern. The averages of these regressions are reported in the next six rows; the results are similar to those for the time series regressions.

The averages of the seven cross sectional regressions are reported in the last six rows. The results are similar to those for the pooled regressions. The average regression coefficient on cash and investments is negative, contrary to prediction. The average regression coefficient on operating cash flow is significantly positive but significantly less than +1, contrary to prediction. The average regression coefficient on change in dividends is significantly less than one, also contrary to prediction.

Since the theoretical model does not have an intercept term, the regressions were repeated using the same data as in table 3.18 but constraining the intercept term to be zero. The results are reported in table 3.19. The regression coefficients on cash and investments are generally significantly positive and significantly less than one as predicted, indeed they are close to the predicted value of 16%, which is the approximate value of the discount rate. The coefficients on operating cash flow are significantly positive, but are also significantly less than the predicted value of one. The coefficients on the change in dividends are positive, but not significantly greater than one.

In summary, the estimated coefficients on cash and investments are generally significantly positive as predicted, but larger than the predicted value in the time series regressions. They are negative, contrary to prediction, only in the pooled and cross sectional regressions which include the intercept. The coefficients on operating cash flow are significantly positive as predicted, but are lower than the predicted value of +1 except for the mean time series regressions which include the intercept. The mean time series estimate of the dividend response coefficients are significantly greater than one as predicted, when the regressions include an intercept. However the median time series estimates and the cross sectional and pooled estimate are less than one, contrary to prediction.

As noted earlier, the low estimated coefficient on operating cash flow may be due to measurement error. In particular, ignoring debt and taxes causes the proxy to be overstated and the regression coefficient to be understated. The generally low significance of the estimated dividend response coefficients may be due to measurement error in the proxy, or due to the slope coefficient not being constant across firms and over time. The latter issue is least likely to cause problems in the time series regressions, which are also where the largest response coefficients are observed. It is also these response coefficients which are used in the subsequent tests of hypotheses H7, H8, and H9. The large time series regression coefficients on cash and investments may be due to the errors in the other proxies or to cash flow shocks.

The appendix reports the results of regressing the same equations using quarterly data and later time periods for the returns. The proxies used above assume that common stock prices adjust for the changes in dividends and cash flows by the end of the period, even though those changes are generally not announced till several weeks later. Measuring the returns over later periods (months 3 to 14 for the annual data and months 2 to 4 for the quarterly data) attempts to adjust for this delay in information release. The regression results for cash and investments and operating cash flows are similar to those discussed above. Some of the dividend response coefficients obtained are significantly greater than one, but some are negative.

The support for hypothesis H6 is mixed. Generally the regression results support the predicted signs of the relation between returns and cash and investments and operating cash flow, but the magnitude of the coefficients on operating cash flow is generally less than one, possibly due to ignoring tax effects. The evidence on the dividend response coefficient is mixed.

3.5.5 Tests of hypotheses H7 to H9

Table 3.20 provides the results of regressing the dividend response coefficients obtained in the time series regressions (rows 4 to 15) of tables 3.18 and 3.19 on the payout rate, beta, and the dividend growth rate. The regression coefficient b_1 on the payout rate is negative as predicted in hypothesis H7, though significantly so only when the intercept was suppressed in estimated the response coefficient. The regression coefficient b_2 on firm betas is negative as predicted in hypothesis H8, but insignificantly so. The regression coefficient b_3 on the dividend growth rate is significantly positive as predicted by hypothesis H9.

The appendix reports the results of alternate tests of the hypothesis. These tests include running the regression in log linear form, using the growth rate for operating cash flows instead of the growth rate for dividends, using dividend response coefficients estimated using returns over the period March 1 to February 28, rather than January 1 to December 31, and using quarterly data. In summary, the regressions provide strong support for the prediction (hypothesis H7) that the dividend response coefficient is inversely related to the payout rate, and for the prediction (hypothesis H9) that the dividend response coefficient is related to the growth rate. Some support is provided for the prediction (hypotheses H8) that the response coefficient is inversely related to beta, but the support is not consistent across proxies and methods of calculating the response coefficient.

3.6 *Summary and conclusion*

This paper examined how dividends affect firm value. When there are other sources of information about the firm's future cash flows, dividends were predicted to be inversely related to firm value due to their tax cost. In the absence of other sources of information, dividends were predicted to be directly related to firm value.

The paper also proposed that future cash flows can arise from two types of assets. Financial assets produce constant marginal returns; their market value equals the present value of their expected future cash flows. Real (or operating) assets produce decreasing returns to scale; their market value is less than the present value of the expected future operating cash flows the firm should realize. Since monitoring may increase this present value and higher payout rates encourage more monitoring, dividends were hypothesized to provide information about expected future operating cash flows.

The dividend response coefficient, the observed relation between (changes in) firm value and (changes in) dividends when dividends are providing information about future operating cash flows, was predicted to vary across firms. It was predicted to be lower for firms with higher payout rates since those rates would imply a smaller change in future operating cash flows for any given change in dividends, it was predicted to be lower for firms with higher discount rates because the higher rates would produce lower present values, and it was predicted to be higher for firms with higher dividend growth rates since those rates would imply a larger change in future operating cash flows for any given change in dividends.

The hypotheses were tested using annual 1980–87 data for 249 publicly traded firms. When firm value was regressed on the proxies for financial assets, expected future operating cash flows, and expected future dividends, the dividend response coefficient was positive when fewer than five years of future results were used, but negative when more than six years of future results were used and payout rates were also included in the regression. When firm value was regressed on the proxies for financial assets and current dividends, the dividend response coefficient was significantly greater than one as predicted. When change in firm value was regressed on the proxies for financial assets, current operating cash flows, and current change in dividends, the sign of the dividend response coefficient was generally positive, but also generally less than one, contrary to prediction.

The regression coefficients on the proxies for financial assets were significantly positive but their magnitude was sometimes significantly different than one contrary to prediction. The regression coefficients on the proxies for operating cash flows were significantly positive but usually significantly less than the predicted value of one. This is likely due to having failed to adjust the proxy for the income tax on the operating cash flow.

The empirical tests support the hypotheses that the dividend response coefficient is a decreasing function of the payout rate and an increasing function of the growth rate. However, the tests do not find a clear relation between the response coefficient and the firm's beta.

The results indicate that the dividend response coefficient is not a constant. Its sign may vary depending on what other variables are assumed to affect firm value. Its magnitude may vary as firms specific rates vary.

Because of these variations, the observed size of the dividend response coefficient in this and other papers may be understated. The fact that the response coefficient is not a constant means that failure to control for the sources of its variation may produce the equivalent of an error in variables problem that biases the observed regression coefficient to zero.

Table 3.1: Sample selection criteria

Number of firms on Compustat	7026
Number of firms eliminated because they had other than December yearend (5360), did not report common dividends (5466), or did not disclose cash (4130) or primary earnings per share (3964)	6221
Firms selected from Compustat	805
Number of firms on CRSP monthly file	3780
Less those missing prices for December 31, 1979 to December 31, 1986	2719
Firms selected from CRSP	1061
Firms on both CRSP and Compustat	352
Less those firms whose first dividend is declared after August 1, 1980 or whose last dividend is declared before November 1, 1987	14
	338
Less those firms which paid dividends other than ordinary taxable dividends or stock dividends	45
	293
Less firms with insufficient information to calculate operating cash flow	44
Firms in sample	249

Table 3.2: Distribution of the sample among industries

Number	SIC	
7	1000	Mining
3	1500	Construction
12	2000	Manufacturing: food
2	2100	Manufacturing: tobacco
2	2200	Manufacturing: textile
1	2300	Manufacturing: apparel
1	2400	Manufacturing: lumber
1	2500	Manufacturing: furniture
16	2600	Manufacturing: paper
6	2700	Manufacturing: printing
36	2800	Manufacturing: chemicals
13	2900	Manufacturing: petroleum
9	3000	Manufacturing: rubber
0	3100	Manufacturing: leather
7	3200	Manufacturing: stone, clay, glass
9	3300	Manufacturing: primary metal
11	3400	Manufacturing: fabricated metal
20	3500	Manufacturing: industrial machinery
16	3600	Manufacturing: electronic and electric
12	3700	Manufacturing: transportation
9	3800	Manufacturing: instruments
0	3900	Manufacturing: misc.
35	4000	Transportation and public utilities
10	5000	Wholesale and retail trade
4	6000	Finance, insurance, and real estate
7	7000	Services

Table 3.3: Constructs, proxies, and predicted coefficients for tests of the relation between nonoperating assets, dividends, and firm value

Theoretical model				Empirical model			
Construct[1]	Coefficient			Proxy[2]	Coefficient		
Firm value				Common stock value, 31 Dec t			
Nonoperating assets	α_1	$=$	$+1$	Cash and investments, 31 Dec t	a_1	$=$	$+1$
Dividends	α_2	$>$	$+1$	Dividends declared, 5 Mar t to 4 Mar t+1	a_2	$>$	$+1$

Proxies defined in terms of compustat definitions and item numbers		
Cash and investments equals		
+	D1	Cash and short-term investments
+	D31[3]	Investments and advances – equity method
+	D32[3]	Investments and advances – other

Notes:

[1] All measured at the end of period t.

[2] All proxies are scaled by number of common shares used to calculate primary earnings per share.

[3] If no data available on Compustat, then amount assumed to be zero.

Table 3.4: Constructs, proxies, and predicted coefficients for tests of the relation between nonoperating assets, cash flow from operations, the change in dividends, and the change in firm value

Model		Test	
Construct	Coefficient	Proxy[2]	Coefficient
Change in firm value		Change in common stock price during t	
Nonoperating assets	$r-1$	Cash and investments, 31 Dec t-1	(0,1)
Operating cash flow	+1	Operating cash flow during t	+1
Change in dividends	>1	Dividends declared, 5 Mar t to 4 Mar t+1 – dividends declared, 5 Mar t-1 to 4 Mar t	>1

Proxies defined in terms of compustat definitions and item numbers

Cash and investments equals		
+	D1	Cash and short-term investments
+	D31[3]	Investments and advances – equity method
+	D32[3]	Investments and advances – other
Operating cash flow equals		
+	D13	Operating income before depreciation
–	D128[3]	Capital expenditures
+	D107[3]	Proceeds of sale of property, plant, and equipment
+		Decrease in non-cash working capital
Non-cash working capital equals		
+	D4	Current assets
–	D1	Cash and short-term investments
–	D70	Accounts payable
–	D72	Current liabilities – other (than accounts payable, debt in current liabilities and income taxes payable)

Notes:

[2] All proxies are scaled by number of common shares used to calculate primary earnings per share times the common share price at the beginning of the period.

[3] If no data available on Compustat, then amount assumed to be zero.

Table 3.5: Constructs, proxies, and predicted coefficients for tests of the relation between nonoperating assets, operating cash flow, dividends, and firm value

Theoretical model		Empirical model	
Construct[1]	Coefficient	Proxy[2]	Coefficient
Firm value		Common stock value, 31 Dec t_1	
Nonoperating assets	$\gamma_1=+1$	Cash and investments, 31 Dec t_1	$a_1=+1$
Present value of operating cash flow	$\gamma_2=+1$	Operating cash flow, 1 Jan t_2 to 31 Dec t_n	$a_2=+$
Present value of dividend tax cost	$\gamma_3=-1$	Dividends declared, 5 Mar t_2 to 4 Mar t_n	$a_3=-$

Proxies defined in terms of compustat definitions and item numbers

Cash and investments equals		
+	D1	Cash and short-term investments
+	D31[3]	Investments and advances – equity method
+	D32[3]	Investments and advances – other
Operating cash flow equals		
+	D13	Operating income before depreciation
–	D128[3]	Capital expenditures
+	D107[3]	Proceeds of sale of property, plant, and equipment
+		Decrease in non-cash working capital
Non-cash working capital equals		
+	D4	Current assets
–	D1	Cash and short-term investments
–	D70	Accounts payable
–	D72	Current liabilities – other (than accounts payable, debt in current liabilities and income taxes payable)

Notes:
[1] All measured at the end of period t_1.
[2] All proxies are scaled by number of common shares used to calculate primary earnings per share.
[3] If no data available on Compustat, then amount assumed to be zero.

Table 3.6: Constructs, proxies, and predicted coefficients for tests of the variation in the dividend response coefficient, when the coefficient estimated by regressing firm value on dividends

Theoretical model	Empirical model	
Construct[1]	Proxy[2]	Coefficient
Dividend payout rate	Dividends / operating cash flow	–
Discount rate (risk)	Market model beta	–
Growth rate	Growth in annual dividends	+

Notes:

[1] The construct is assumed to be intertemporally constant.

[2] The proxies are estimated for each firm using its annual data for 1980 to 1987.

Table 3.7: Descriptive statistics for cash flow from operating and nonoperating activities, dividends, and firm value, when association period is the year itself

	Mean	St D	Q1	Q2	Q3	Obs
Price at Dec 31	57.741	38.901	30	48	74.5	1743
Month 1 to 12 returns	0.177	0.299	-0.016	0.152	0.337	1743
Cash and investments[1]	0.200	0.211	0.074	0.132	0.260	1743
Cash and investments per share	10.044	11.074	3.276	6.570	13.041	1743
Operating cash flow[1]	0.134	0.169	0.058	0.119	0.200	1743
Change in dividends[1]	0.002	0.137	0	0.002	0.004	1743
Dividends per share	2.104	3.962	1.137	1.762	2.523	1743

Notes:
Table provides the predicted value, the mean, the standard deviation, the first, second, and third quartiles, and the number of observations, and the reference for each variable.
[1] Scaled by market value of the firm's common stock at the beginning of the year.

Table 3.8: Tests of hypothesis H1: evidence on the relation between firm value, nonoperating assets, operating cash flow, and dividends

$$\text{Firm value}, t_1 = a_0 + a_1 * \text{Nonoperating assets}, t_1 + a_2 * \text{Operating cash flow}, t_1 - t_2 + a_3 * \text{Dividends}, t_1 - t_2$$

t_1–t_2	a_0	a_1	a_2	a_3	Adjusted	White's	Largest
Prediction		+1	+	−	R^2	χ^2	VIF
1980–87	20.58	0.84	0.12	0.08	.26	.07	1.32
	(.000)	(.000)	(.000)	(.955)			
1980–85	19.11	0.80	0.14	0.36	.29	.04	1.10
	(.000)	(.000)	(.000)	(.999)			
1982–87	26.18	0.58	0.20	0.17	.20	.62	1.20
	(.000)	(.000)	(.000)	(.998)			
1980–83	17.09	0.71	0.13	1.23	.32	.08	1.23
	(.000)	(.000)	(.003)	(.999)			
1984–87	36.17	0.95	0.32	0.20	.25	.09	1.44
	(.000)	(.000)	(.000)	(.986)			
1980–81	21.54	0.87	0.21	1.21	.23	.04	1.09
	(.000)	(.000)	(.008)	(.999)			
1982–83	17.68	0.33	0.19	4.66	.31	.15	1.43
	(.000)	(.020)	(.053)	(.999)			
1984–85	39.07	1.03	0.56	0.30	.19	.04	1.04
	(.000)	(.000)	(.000)	(.939)			
1986–87	38.41	1.03	1.10	0.32	.39	.00	1.36
	(.000)	(.000)	(.000)	(.995)			

Notes:

See proxy definitions on table 3.5.

VIF = Variance inflation factor.

Values in brackets are significance levels based on one tail t tests of the null hypothesis that the parameter estimate is zero (except for the intercept, which are two tail).

Table 3.9: Tests of hypothesis H1: evidence on the relation between firm value, nonoperating assets, operating cash flow, and dividends, intercept constrained to zero

$$\text{Firm value}, t_1 = +a_1 * \text{Nonoperating assets}, t_1 + a_2 * \text{Operating cash flow}, t_1 - t_2 + a_3 * \text{Dividends}, t_1 - t_2$$

t_1–t_2 Prediction	a_1 +1	a_2 +	a_3 −	Adjusted R^2	White's χ^2	Largest VIF
1980–87	1.58	0.27	0.13		.05	1.29
	(.001)	(.001)	(.992)			
1980–85	1.43	0.30	0.67		.00	1.00
	(.000)	(.000)	(.999)			
1982–87	1.52	0.46	0.25		.03	1.17
	(.000)	(.000)	(.999)			
1980–83	1.14	0.28	2.13	.07	.27	1.04
	(.000)	(.000)	(.999)			
1984–87	2.02	0.71	0.25		.11	1.35
	(.000)	(.000)	(.985)			
1980–81	1.74	0.64	2.64		.08	1.00
	(.000)	(.000)	(.999)			
1982–83	0.61	0.27	7.42	.16	.70	1.31
	(.000)	(.018)	(.999)			
1984–85	2.32	1.28	0.81		.00	1.00
	(.000)	(.000)	(.999)			
1986–87	2.07	1.75	0.32	.11	.01	1.24
	(.000)	(.000)	(.983)			

Notes:

See proxy definitions on table 3.5.

VIF = Variance inflation factor.

Values in brackets are significance levels based on one tail t tests of the null hypothesis that the parameter estimate is zero (except for the intercept, which are two tail).

Table 3.10: Tests of hypothesis H1: evidence on the relation between firm value, nonoperating assets, operating cash flow, dividends, and the payout rate

$$\text{Firm value}, t_1 = a_0 + a_1 * \text{Nonoperating assets}, t_1 + a_2 * \text{Operating cash flow}, t_1 - t_2 + a_3 * \text{Dividends}, t_1 - t_2 + a_4 * \text{Payout rate}, t_1 - t_2$$

t1–t2	a_0	a_1	a_2	a_3	a_4	Adjusted	White's	Largest
Prediction		+1	+	−	+	R^2	χ^2	VIF
1980–87	4.87	0.60	0.27	-0.13	31.44	.34	.00	3.03
	(.132)	(.000)	(.000)	(.010)	(.000)			
1980–85	4.11	0.48	0.34	0.15	29.96	.38	.02	2.46
	(.174)	(.000)	(.000)	(.963)	(.000)			
1982–87	8.77	0.37	0.41	-0.01	30.80	.26	.02	2.52
	(.046)	(.012)	(.000)	(.466)	(.000)			
1980–83	10.53	0.58	0.30	0.90	14.60	.34	.05	2.70
	(.000)	(.000)	(.000)	(.999)	(.002)			
1984–87	17.81	0.79	0.60	-0.07	34.34	.29	.02	2.95
	(.002)	(.000)	(.000)	(.286)	(.000)			
1980–81	14.57	0.77	0.50	0.82	13.81	.25	.14	2.51
	(.000)	(.000)	(.000)	(.995)	(.002)			
1982–83	13.46	0.28	0.39	4.15	9.99	.31	.33	3.18
	(.000)	(.040)	(.015)	(.999)	(.068)			
1984–85	17.38	0.82	1.14	0.09	37.85	.25	.02	2.05
	(.002)	(.000)	(.000)	(.686)	(.000)			
1986–87	19.38	0.86	1.56	0.04	35.15	.41	.00	2.71
	(.005)	(.000)	(.000)	(.606)	(.001)			

Notes:
See proxy definitions on table 3.5.
VIF = Variance inflation factor.
Values in brackets are significance levels based on one tail t tests of the null hypothesis that the parameter estimate is zero (except for the intercept, which are two tail).

Table 3.11: Tests of hypothesis H1: evidence on the relation between firm value, nonoperating assets, operating cash flow, dividends, and the payout rate, intercept constrained to zero

$$\text{Firm value}, t_1 = +a_1 * \text{Nonoperating assets}, t_1 + a_2 * \text{Operating cash flow}, t_1 - t_2 + a_3 * \text{Dividends}, t_1 - t_2 + a_4 * \text{Payout rate}, t_1 - t_2$$

t_1–t_2 Prediction	a_1 +1	a_2 +	a_3 −	a_4 +	Adjusted R^2	White's χ^2	Largest VIF
1980–87	0.58	0.32	-0.18	38.75	.34	.00	1.66
	(.000)	(.000)	(.000)	(.000)			
1980–85	0.46	0.39	0.13	35.81	.37	.01	1.30
	(.000)	(.000)	(.939)	(.000)			
1982–87	0.37	0.512	-0.07	42.75	.25	.01	1.38
	(.014)	(.000)	(.129)	(.000)			
1980–83	0.55	0.50	0.79	29.23	.31	.15	1.60
	(.000)	(.000)	(.999)	(.000)			
1984–87	0.81	0.85	-0.25	58.96	.26	.05	1.63
	(.000)	(.000)	(.006)	(.000)			
1980–81	0.82	0.99	0.57	33.29	.18	.05	1.31
	(.000)	(.000)	(.961)	(.000)			
1982–83	0.29	0.79	4.10	28.30	.27	.20	1.96
	(.079)	(.000)	(.999)	(.000)			
1984–85	0.86	1.57	0.04	59.49	.22	.01	1.09
	(.000)	(.000)	(.583)	(.000)			
1986–87	0.87	2.00	-0.17	61.37	.40	.00	1.41
	(.000)	(.000)	(.100)	(.000)			

Notes:

See proxy definitions on table 3.5.

VIF = Variance inflation factor.

Values in brackets are significance levels based on one tail t tests of the null hypothesis that the parameter estimate is zero (except for the intercept, which are two tail).

Table 3.12: Tests of hypothesis H1: evidence on the relation between firm value, nonoperating assets, operating cash flow, dividends, the payout rate, and the payout rate squared

$$\begin{aligned}\text{Firm value, } t_1 &= a_0 + a_1 * \text{Nonoperating assets, } t_1 + a_2 * \text{Operating cash flow, } t_1 - t_2 \\ &+ a_3 * \text{Dividends, } t_1 - t_2 + a_4 * \text{Payout rate, } t_1 - t_2 \\ &+ a_5 * \text{Payout rate squared, } t_1 - t_2\end{aligned}$$

t_1–t_2 Prediction	a_0	a_1 +1	a_2 +	a_3 –	a_4 +	a_5 –	Adjusted R^2	White's χ^2	Largest VIF
1980–87	-8.04	0.57	0.30	-0.16	86.22	-45.08	.37	.06	24.45
	(.105)	(.000)	(.000)	(.002)	(.000)	(.000)			
1980–85	-4.76	0.49	0.36	0.12	70.38	-34.10	.39	.03	24.31
	(.283)	(.000)	(.000)	(.919)	(.000)	(.004)			
1982–87	0.25	0.39	0.41	-0.01	67.59	-31.13	.27	.13	23.69
	(.969)	(.009)	(.000)	(.466)	(.001)	(.039)			
1980–83	2.10	0.61	0.34	0.71	54.55	-32.25	.36	.07	30.99
	(.640)	(.000)	(.000)	(.999)	(.001)	(.008)			
1984–87	6.64	0.76	0.64	-0.08	85.49	-43.17	.29	.02	24.73
	(.448)	(.000)	(.000)	(.234)	(.003)	(.045)			
1980–81	8.86	0.80	0.52	0.74	41.49	-23.51	.26	.15	27.84
	(.042)	(.000)	(.000)	(.990)	(.005)	(.036)			
1982–83	25.11	0.25	0.18	5.26	-50.54	48.19	.32	.17	35.09
	(.000)	(.060)	(.173)	(.999)	(.978)	(.994)			
1984–85	8.61	0.81	1.17	0.08	80.01	-35.54	.25	.03	27.88
	(.304)	(.000)	(.000)	(.660)	(.005)	(.079)			
1986–87	-12.26	0.83	1.77	-0.03	180.01	-123.02	.45	.00	23.46
	(.211)	(.000)	(.000)	(.419)	(.000)	(.000)			

Notes:
See proxy definitions on table 3.5.
VIF = Variance inflation factor.
Values in brackets are significance levels based on one tail t tests of the null hypothesis that the parameter estimate is zero (except for the intercept, which are two tail).

Table 3.13: Tests of hypothesis H1: evidence on the relation between firm value, nonoperating assets, operating cash flow, dividends, the payout rate, and the payout rate squared, intercept constrained to zero

$$\begin{aligned}\text{Firm value}, t_1 &= +a_1 * \text{Nonoperating assets}, t_1 + a_2 * \text{Operating cash flow}, t_1 - t_2\\ &+ a_3 * \text{Dividends}, t_1 - t_2 + a_4 * \text{Payout rate}, t_1 - t_2\\ &+ a_5 * \text{Payout rate squared}, t_1 - t_2\end{aligned}$$

t_1–t_2 Prediction	a_1 +1	a_2 +	a_3 −	a_4 +	a_5 −	Adjusted R^2	White's χ^2	Largest VIF
1980–87	0.59	0.26	-0.12	61.06	-28.41	.36	.02	8.35
	(.000)	(.000)	(.008)	(.000)	(.001)			
1980–85	0.50	0.33	0.14	55.40	-24.04	.39	.05	9.68
	(.000)	(.000)	(.956)	(.000)	(.002)			
1982–87	0.39	0.41	-0.01	68.35	-31.64	.27	.13	10.01
	(.009)	(.000)	(.459)	(.000)	(.004)			
1980–83	0.61	0.37	0.67	61.69	-37.08	.36	.05	10.43
	(.000)	(.000)	(.999)	(.000)	(.000)			
1984–87	0.76	0.69	-0.12	106.61	-57.61	.29	.04	9.59
	(.000)	(.000)	(.126)	(.000)	(.000)			
1980–81	0.83	0.68	0.61	69.87	-42.90	.25	.16	11.93
	(.000)	(.000)	(.974)	(.000)	(.000)			
1982–83	0.30	0.75	3.76	42.73	-15.56	.28	.36	10.83
	(.071)	(.000)	(.999)	(.000)	(.105)			
1984–85	0.82	1.28	0.06	107.56	-54.70	.25	.03	11.59
	(.000)	(.000)	(.622)	(.000)	(.001)			
1986–87	0.83	1.60	0.04	141.69	-96.82	.45	.00	9.16
	(.000)	(.000)	(.632)	(.000)	(.000)			

Notes:

See proxy definitions on table 3.5.

VIF = Variance inflation factor.

Values in brackets are significance levels based on one tail t tests of the null hypothesis that the parameter estimate is zero (except for the intercept, which are two tail).

Table 3.14: Tests of hypothesis H2: evidence on the relation between cash and investments, dividends, and firm value

$$\text{Firm value} = a_0 + a_1 * \text{Cash and investments} + a_2 * \text{Dividends}$$

Year Prediction	a_0 0	a_1 +1	a_2 > 1	Adjusted R^2	White's χ^2	Largest VIF
Panel A: pooled regression						
Pooled[1]	42.94	1.24	1.14	.144	.000	1.01
	.000	.001	.262			
Panel B: time series regressions						
Mean t.s.[2]	-16.58	1.12	38.46			
	.047	.361	.000			
Median t.s.[2]	-16.40	0.67	26.84			
	.013	.146	.000			
Mean t.s.a.[3]	-18.19	1.11	39.80			
	.036	.377	.000			
Median t.s.a.[3]	-13.50	0.79	28.37			
	.011	.131	.000			
Panel C: cross sectional regressions						
1980	22.77	0.80	8.80	.204	.124	1.24
	.000	.198	.000			
1981	32.43	0.78	0.80	.083	.236	1.00
	.000	.099	.680			
1982	25.66	0.50	9.58	.196	.156	1.14
	.000	.006	.000			
1983	30.41	0.80	10.24	.232	.036	1.12
	.000	.157	.000			
1984	25.20	0.41	13.12	.316	.304	1.10
	.000	.000	.000			
1985	54.40	1.51	0.08	.144	.002	1.00
	.000	.013	.999			
1986	25.43	0.38	22.96	.429	.131	1.10
	.000	.000	.000			
Mean c.s[4]	30.90	0.74	9.37			
	.000	.064	.014			
Median c.s[4]	25.66	0.78	9.58			
	.016	.078	.039			

Notes:

The second row of each pair of rows gives the (one tail) probability of observing the regression coefficient above, given the null hypothesis that the coefficient is one. (Except for the intercept which is a two tail test of the null hypothesis that it is zero. The median test is a nonparametric sign test.)

See table 3.3 for proxy definitions.

[1] 1743 observations

[2] Mean or median of 249 time series regressions of 7 years each.

[3] Mean or median of 249 time series regressions of 7 years each, assuming first order autocorrelation of the residual term.

[4] Mean or median of 7 cross-sectional regressions of 249 firms each.

Table 3.15: Tests of hypothesis H2: evidence on the relation between cash and investments, dividends, and firm value, when intercept set to zero

$$\text{Firm value} = +a_1 * \text{Cash and investments} + a_2 * \text{Dividends}$$

Year Prediction	a_1 +1	a_2 > 1	Adjusted R^2	White's χ^2	Largest VIF
Panel A: pooled regression					
Pooled[1]	2.89	3.56		.001	1.00
	.000	.000			
Panel B: time series regressions					
Mean t.s.[2]	1.71	29.57			
	.122	.000			
Median t.s.[2]	1.19	22.40			
	.323	.000			
Mean t.s.a.[3]	1.72	29.69			
	.116	.000			
Median t.s.a.[3]	1.18	21.43			
	.326	.000			
Panel C: cross sectional regressions					
1980	1.03	17.94	.033	.301	1.22
	.451	.000			
1981	2.54	3.31		.343	1.00
	.000	.000			
1982	0.87	18.47		.082	1.08
	.273	.000			
1983	1.20	20.13	.028	.041	1.04
	.169	.000			
1984	0.69	20.82	.166	.140	1.04
	.039	.000			
1985	3.83	0.81		.013	1.00
	.000	.708			
1986	0.50	30.09	.373	.380	1.08
	.001	.000			
Mean c.s.[4]	1.52	15.94			
	.149	.004			
Median c.s.[4]	1.03	18.47			
	.344	.016			

Notes:

The second row of each pair of rows gives the (one tail) probability of observing the regression coefficient above, given the null hypothesis that the coefficient is one. (The median test is a nonparametric sign test.)

See table 3.3 for proxy definitions.

[1] 1743 observations

[2] Mean or median of 249 time series regressions of 7 years each.

[3] Mean or median of 249 time series regressions of 7 years each, assuming first order autocorrelation of the residual term.

[4] Mean or median of 7 cross-sectional regressions of 249 firms each.

Table 3.16: Descriptive statistics for firm rates

	Mean	St D	Q1	Q2	Q3	Obs
Dividend payout rate	0.419	0.253	0.247	0.346	0.493	249
Firm betas	0.994	0.242	0.841	1.010	1.152	249
Dividend growth rate	1.056	0.082	1.020	1.052	1.099	249
Operating cash flow growth rate	1.074	0.178	0.992	1.089	1.164	249

Notes:

Table provides the predicted value, the mean, the standard deviation, the first, second, and third quartiles, and the number of observations, and the reference for each variable.

Table 3.17: Test of hypotheses H3 to H5: evidence on the cross-sectional variation in the dividend response coefficient, when the coefficient estimated by regressing firm value on dividends

$$\text{Dividend response coefficient} = b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} + b_3 * \text{Dividend growth rate}$$

b_0	b_1	b_2	b_3	Adjusted
Prediction	–	–	+	R^2
13.81	-16.77	17.11	80.99	.140
.172	.070	.946	.019	

Notes:
See table 3.6 for proxy definitions
The dividend response coefficient is from table 3.15 where the intercept is set to zero.
The second row gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t test except for the intercept which is two tail.)

Table 3.18: Tests of hypothesis H6: evidence on the relation between cash flow from operating and nonoperating activities, the change in dividends, and the change in firm value when the association period is months 1 to 12 (the year itself)

$$\text{Returns} = b_0 + b_1 * \text{Cash and investments} + b_2 * \text{Operating cash flow} + b_3 * \text{Change in dividends}$$

Case	b_0	b_1	b_2	b_3
Predicted	0	+	1	+
Pooled[1]	0.126	-0.001	0.384	0.006
	.000	.512	.000	.452
		.000	.000	.000
Mean t.s.[2]	-0.240	1.962	1.003	16.593
	.000	.000	.000	.031
		.016	.987	.079
Median t.s.[3]	-0.150	1.030	0.609	0.009
	.000	.000	.000	.094
		.214	.061	.300
Mean t.s.a.[4]	-0.206	1.803	0.966	13.188
	.000	.000	.000	.111
		.049	.861	.259
Median t.s.a.[5]	-0.138	0.764	0.594	0.000
	.000	.000	.000	
		.394	.037	.496
Mean c.s.[6]	0.134	-0.031	0.354	0.212
	.054	.761	.002	.275
		.000	.000	.057
Median c.s.[7]	0.232	-0.010	0.441	0.008
	.156	.656	.016	.500
		.016	.016	.156

Notes:
The second row of each set of rows gives the (one tail) probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (Except for the intercept which is two tail.) The third row of each set of rows gives the (two tail) probability of observing the regression coefficient above, given the null hypothesis that the coefficient is one.
Tests of means and pooled regressions are t tests; tests of medians are nonparametric sign tests.
See table 3.4 for proxy definitions.
[1] 1743 observations.
Adjusted R^2 = .0455, White's χ^2 statistic = .0281, Largest variance inflation factor = 1.001.
[2] Mean of 249 time series regressions of 7 observations each.
[3] Median of 249 time series regressions of 7 observations each.
[4] Mean of 249 time series regressions of 7 observations each, assuming first order autoregression in the residual term
[5] Median of 249 time series regressions of 7 observations each, assuming first order autoregression in the residual term
[6] Mean of 7 cross sectional regressions of 249 observations each.
[7] Median of 7 cross sectional regressions of 249 observations each.

Table 3.19: Tests of hypothesis H6: evidence on the relation between cash flow from operating and nonoperating activities, the change in dividends, and the change in firm value, when intercept set to 0 and the association period is months 1 to 12 (the year itself)

$$\begin{aligned} \text{Returns} &= b_1 * \text{Cash and investments} + b_2 * \text{Operating cash flow} \\ &+ b_3 * \text{Change in dividends} \end{aligned}$$

Case	b_1	b_2	b_3
Predicted	+	1	+
Pooled[1]	0.221	0.613	0.020
	.000	.000	.351
	.000	.000	.000
Mean t.s.[2]	0.871	0.641	2.826
	.001	.000	.338
	.628	.016	.787
Median t.s.[3]	0.356	0.549	1.983
	.000	.000	.146
	.000	.000	.439
Mean t.s.a.[4]	0.781	0.670	1.002
	.001	.000	.451
	.359	.027	.999
Median t.s.a.[5]	0.367	0.553	1.739
	.000	.000	.124
	.000	.000	.392
Mean c.s.[6]	0.196	0.580	0.324
	.043	.000	.144
	.000	.002	.053
Median c.s.[7]	0.286	0.560	0.048
	.109	.008	.078
	.016	.016	.047

Notes:
The second row of each set of rows gives the (one tail) probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (Except for the intercept which is two tail.) The third row of each set of rows gives the (two tail) probability of observing the regression coefficient above, given the null hypothesis that the coefficient is one.
Tests of means and pooled regressions are t tests; tests of medians are nonparametric sign tests.
See table 3.4 for proxy definitions.
[1] 1743 observations.
White's χ^2 statistic = .1226, Largest variance inflation factor = 1.000.
[2] Mean of 249 time series regressions of 7 observations each.
[3] Median of 249 time series regressions of 7 observations each.
[4] Mean of 249 time series regressions of 7 observations each, assuming first order autoregression in the residual term
[5] Median of 249 time series regressions of 7 observations each, assuming first order autoregression in the residual term
[6] Mean of 7 cross sectional regressions of 249 observations each.
[7] Median of 7 cross sectional regressions of 249 observations each.

Table 3.20: Tests of hypotheses H7 to H9: evidence on the cross-sectional variation in dividend response coefficients, when association period is the year

$$\text{Response coefficient} = b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} + b_3 * \text{Dividend growth rate}$$

	b_0	b_1	b_2	b_3	Adjusted	White's	Largest
Predicted		–	–	+	R^2	χ^2	VIF
1	34.804	-38.098	-15.486	235.494	.0159	.1366	1.033
	.383	.141	.336	.016			
2	40.927	-55.111	-17.942	236.338	.0116	.3625	1.033
	.401	.101	.343	.038			
3	44.148	-42.608	-32.972	167.014	.0257	.1912	1.033
	.146	.057	.117	.022			
4	45.459	-51.468	-32.733	173.120	.0194	.3373	1.033
	.211	.056	.162	.041			

Notes:
See table 3.6 for proxy definitions.
The dividend response coefficient is from:

- for the first regression: the time series regressions in table 3.18;
- for the second regression: the time series regressions in table 3.18, where the residual term is assumed autoregressive;
- for the third regression: the time series regressions in table 3.19 where the intercept is set to zero;
- for the fourth regression: the time series regressions in table 3.19 where the intercept is set to zero and the residual term is assumed autoregressive.

The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

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Appendix A

WHY DO FIRMS PAY DIVIDENDS?

The purpose of this appendix is to provide additional motivation for the importance of dividends in firm valuation. It begins with a review of the relevant literature, and then develops a model in which the optimal dividend is a function of expected future operating (cash) income.

Miller and Modigliani (1961) demonstrated that under certain assumptions, the payment of dividends is irrelevant in determining firm value. Relaxing those assumptions leads to conditions under which paying dividends affects firm value.

There are several reasons why firms might not pay dividends. Management compensation may be an increasing function of firm assets or an increasing function of earnings which are themselves an increasing function of assets. Since the payment of dividends reduces assets, it may not be in management's interests.

Investors pay brokerage fees, typically about 2%, to purchase stock. If they receive a dividend and do not need the cash for consumption, they must incur costs in arranging to reinvest the cash. Some large companies do allow investors to direct that their dividends be reinvested in treasury stock, thereby avoiding these transaction costs.

To the extent that the firm uses its cash to pay dividends, it has less cash available to invest. In addition to the costs of raising additional equity, such as those arising from the preparation of a prospectus and from underwriter fees and commissions, Myers and Majluf (1984) argued that management may decline to undertake projects with positive net present value rather than issue shares at less than what they believe to be the true firm value.

Individuals are taxed on the amount of dividends received during the year. Elton and Gruber (1970), Modigliani (1982), and others have argued that the market value of the firm should be reduced by the present value of the net tax cost of the expected stream of future dividends. So the announcement of an unexpected increase in dividends should lower firm value by the unexpected increase in the present value of the resulting tax liability. On the exdividend day, firm value should decrease by less than the dividend paid.

For instance, suppose a stock is trading at \$100, and the tax rate on dividends is 30%. The announcement of an unexpected one-time \$10 increase in dividends would cause the share price to fall by the amount of the tax cost to \$97; on the exdividend day, the price would fall by the after-tax value of the dividend to \$90. However, Miller and Scholes (1978) argued that individuals can effectively shelter their dividend income by buying stocks on credit and deducting the interest expense from the dividend revenue. Thus they would hypothesize no announcement effect and a drop in firm value from \$100 to \$90 on the exdividend day. Elton and Gruber (1970) provided empirical evidence that the exdividend day behaviour of stock prices is consistent with the tax cost; i.e., in the example, the exdividend drop of \$7. On the other hand, many studies have shown that the effect of an announced increase in dividends is to raise firm value, so that some other effect must be stronger than the tax and other effects discussed so far.

Lintner (1956) argued that firms paid dividends because their management believed shareholders had a "special interest in getting dividends." (p.100) He found that firm managers tended to change dividends primarily in response to an unanticipated and nontransitory change in their firm's earnings. But in view of the comments above, it is appropriate to ask why shareholders like dividends, and why it would appear that management adjusts dividends based primarily on changes in current earnings.

Corporate shareholders pay a lower tax rate on dividend income than on realized capital gains. However, unrealized capital gains are tax exempt, so that the net present value of the tax rate on capital gains is a decreasing function of the expected holding time, and may be lower than the dividend tax rate.

Jensen (1986) argued that corporate managers invest cash in excess of that needed for operations suboptimally, so that firm value would be higher if such excess cash were distributed to the shareholders. Such a distribution could take the form of dividends or repurchase of shares. Payment of dividends in excess of this excess cash amount may be optimal if the resulting need to use the procedures for raising new equity submits management or the firm's regulators to the "discipline of the market place."

Easterbrook (1984) proposed two possible reasons for dividends. The first was that dividends adjust the level of risk between bondholders and stockholders. As the firm's debt to equity ratio decreases, the risk of default on bonds falls, so that bondholders gain at the expense of shareholders. If the debt to equity ratio rises, the reverse happens. Bondholders obtain some protection from too large a transfer of wealth to stockholders by restricting the firm's ability to pay dividends; Easterbrook argued that there is an implicit contract between the firm and its shareholders that protects shareholders from too large a transfer of wealth to bondholders by restricting the firms' ability to refuse to pay dividends.

Easterbrook's second reason was that the payment of dividends forces the firm to raise additional funds in the capital markets more frequently and so submits it to the scrutiny of the investment banker or broker who acts on behalf of the new shareholders. However he notes (p.655), "Nothing here suggests that repurchases of shares would not do as well as or better than dividends."

Shleifer and Vishny (1986) argued that effective monitoring of the firm's management to ensure that they are acting in the best interests of shareholders requires the presence of a large shareholder whose gain through increases in firm value from enforcing optimal behaviour exceeds his cost of monitoring. If such large shareholders are typically corporations who prefer dividends to capital gains, then it could be in the interest of all shareholders for the firm to pay sufficient dividends to discourage such a large shareholder from selling his interest in the firm.

If some shareholders need periodic cash receipts from their investments, they may prefer to receive these in the form of dividends, rather than going to the trouble and incurring the transaction costs that arise on the sale of shares. Small shareholders in particular may find the receipt of dividends less costly than attempting to sell odd lots out of a small portfolio while maintaining adequate diversification. Shefrin and Statman (1984) argued that shareholders are reluctant to sell their shares because they are concerned that they will regret the action if the shares subsequently increase in price or because they have a policy of consuming out of income only for reasons of (lack of) self-control. Potential shareholders may prefer a firm that pays regular dividends if they view the dividends as the main benefit from owning the stock and as a form of compensation should the stock fall in value. Long (1978) documented the case of Citizens Utility Company which is apparently consistent with this reason for dividends. However, many mutual funds do offer their investors a method of receiving monthly disbursements primarily in the form of capital gains, without losing the diversification advantage of the fund or consuming out of capital.

Finally, it has been argued that dividends are a means by which the firm conveys information to its shareholders and the market. Penman (1983) found that dividend announcements convey information about management's expectations of firm earnings. His study of 541 management earnings forecasts made in 1968-73 found that they were less accurate predictors of current year earnings than were the forecasts of a model based on prior year earnings and current and prior year dividends. Hakansson (1982, p. 426) demonstrated that dividends can only yield a Pareto improvement in investor welfare if the dividend declaration conveys information. Ambarish et. al. (1987) noted that a firm should use dividends to convey information only if their use is more cost beneficial than other alternatives available to it. In particular, the firm could simply release information through the use of news releases and letters to shareholders. Since both common law and securities legislation contain penalties for misleading shareholders, such means cannot be casually dismissed. Indeed, as noted in Rozeff (1982), payment of dividends generally must be a cost benefit decision, whether the trade-off be between agency costs (as in Jensen (1986) and Jensen and Meckling (1976)) and the costs associated with raising additional equity as in his paper, or among shareholders' need for cash receipts, the costs associate with raising additional equity, and the tax cost to individuals as in Bhattacharya (1979), or between risk and tax costs as in Feldstein and Green (1983), or between the gains from dissemination of additional information and tax or other costs (e.g. Hakansson, 1982 and Ambarish et. al., 1987).

As noted above, firms are required to report their performance at least annually to shareholders. Watts and Zimmerman (1986 and 1990) summarized the extensive literature which demonstrates the usefulness of accounting information, and the sophistication of the market in processing such information. In general, these studies indicate that managers cannot mislead the market by the use of discretionary accounting changes and accruals. Thus it seems unlikely that firms would use dividends to signal past or current performance. However, dividends could be used to indicate expected future performance, including management's beliefs as to the persistence or growth in (cash) earnings.

A.1 A model of optimal dividends

The preceding review of the literature has emphasized the tax cost of dividends to individual shareholders. This cost should not be exaggerated however, since most individuals will eventually need to consume their savings. The following two theorems formalize this notion and provide some more precision to the definitions of the effective tax rate T and the discount rate r used in this paper.

Theorem A.1 *Assuming*

- *perfect capital markets*
- *rational behaviour*
- *perfect certainty*
- *corporations' after tax profit rate is* $r > 1$
- *all corporate income is distributed as dividends*
- *intercorporate dividends are tax exempt*
- *the individual income tax rate is* T_I
- *individuals' discount rate is* $\rho > 1$

then equilibrium requires $\rho = 1 + [r-1][1-T_I]$ *in the sense that if this equality does not hold then there will be either too many or too few investors.*

Proof:

If all earnings from an initial investment of one dollar are paid out as dividends each period and then reinvested, then after the first period the investment is worth:

$$r - [r-1]T_I = 1 + [r-1][1-T_I].$$

After n periods the investment is worth:

$$(1 + [r-1][1-T_I])^n.$$

The present value of the investment is:

$$\frac{(1+[r-1][1-T_I])^n}{\rho^n}.$$

If $\rho = 1+[r-1][1-T_I]$ then the present value is 1; if $\rho > 1+[r-1][1-T_I]$, the present value is less than 1 and declines to 0 as n goes to infinity; if $\rho < 1+[r-1][1-T_I]$, the present value is greater than 1 and increases to infinity as n goes to infinity.

If all earnings from an initial investment of one dollar are paid out as dividends each period and not reinvested, then the present value of the investment is:

$$\rho^{-n} + \sum_{j=1}^{n} \frac{[r-1][1-T_I]}{\rho^j} = \rho^{-n} + \frac{[r-1][1-T_I]}{\rho-1}[1-\rho^{-n}].$$

If $\rho - 1 = [r-1][1-T_I]$ then the present value is 1; if $\rho - 1 > [r-1][1-T_I]$, the present value is less than 1 and declines to $\frac{r-1}{\rho-1}[1-T_I]$ as n goes to infinity; if $\rho - 1 < [r-1][1-T_I]$, the present value is greater than 1 and increases to $\frac{r-1}{\rho-1}[1-T_I]$ as n goes to infinity. QED.

Theorem A.2 *Assuming*

- *perfect capital markets*
- *rational behaviour*
- *perfect certainty*
- *corporations' after tax profit rate is* $r > 1$
- *intercorporate dividends are tax exempt*
- *the individual income tax rate is* T_I
- *individuals' discount rate is* $\rho = 1+[r-1][1-T_I]$

then:

1. *individuals are indifferent between receiving dividends and receiving capital gains to the extent such income is needed for consumption;*

2. *to the extent the increase in the value of their investment is not needed for consumption, individuals prefer companies which do not pay dividends; and*

3. *shareholders who are corporations prefer that the firms they invest in distribute all income as dividends; indeed they will not invest unless they can ensure such is the case.*

Proof:

1. follows from observing that the second paragraph to the preceding theorem is unchanged if the firm invested in does not pay dividends but the individual sells shares in an amount equal to the dividend that would otherwise have been paid.

2. If none of the earnings from an initial investment of one dollar are paid out as dividends, then after the first period the investment is worth:

$$1 + [r - 1][1 - T_I].$$

After n periods the investment is worth:

$$r^n - [r^n - 1]T_I = r^n[1 - T_I] + T_I.$$

The present value of the investment is:

$$\frac{r^n[1 - T_I] + T_I}{\rho^n}.$$

If $r = \rho$ and $T_I = 0$ then the present value is 1; if $r = \rho$ and $T_I > 0$ the present value is less than 1 and declines to $1 - T_I$ as n goes to infinity; if $\rho > r$ the present value is less than 1 and declines to zero as n goes to infinity; if $\rho < r$ as assumed the present value is greater than 1 and increases to infinity as n goes to infinity.

3. Since the corporate shareholder must earn r to satisfy its own shareholders, it can only do so if it receives the firm's income tax free. Since capital gains are taxed at rate T_I, this would make the return too low to satisfy its own shareholders. QED

In the preceding two theorems, ρ represents individuals' discount rate on income received after tax. Their discount rate on before tax income is $1 + \frac{\rho - 1}{1 - T_I} = r$. Thus it is appropriate to use r to discount before tax income in this paper.

Theorem A.2 demonstrates that individual shareholders gain when a firm does not pay dividends to the extent that they do not need to consume the increase in the value of their investment. Thus there is an effective tax gain to capital gains, but it would equal T_I only if individuals were able to defer realization of the gain indefinitely. The effective tax gain is therefore less than T_I and is an increasing function of T_I and of how soon individuals need to realize the gain on their investment. In the remainder of the paper, the only two sources of investor income are dividends and capital gains. It is simpler to use an effective tax cost T to dividends in excess of that to capital gains than to use an effective tax gain T to capital gains in comparison to the tax on dividends.

Part 3 of theorem A.2 is clearly not empirically valid. Although parent corporations can probably ensure that all income of their subsidiaries is transferred to the parent as dividends or in other ways that avoid the double taxation implicit in transferring the income as capital gains, there are situations where corporate shareholders do not control the dividend decisions of the firms they invest in. This may be a temporary situation where the corporation intends to acquire control so that the increase in value can be retroactively transferred to the parent tax free. Alternatively, if the assumption of perfect certainty is dropped, it may be that the corporation believes the firm to be undervalued.

Suppose[1] some corporations are able to identify firms that are undervalued, in the sense that their current management is not making the best use of the assets at its disposal. Current management may or may not be aware of this and may or may not be able to take corrective action. In any case, assume that the corporation believes the most efficient way to correct the problem is a takeover. Since corporations are required to announce takeover bids, assume that they can acquire only $A < 50\%$ of the outstanding shares before making such an announcement, and that after they announce the takeover, the share price adjusts so that there is no gain on the shares acquired after the announcement.

[1] The rest of the appendix is similar to section 1.3.5.

Following Shleifer and Vishny (1986, p. 465), assume the corporation has "access to a technology for finding valuable improvements of [current management's] operating strategy through monitoring and independent research. This technology gives [the corporation] a probability J of drawing an improvement of positive value Z ... for a cost $M(J)$. The variable Z should be interpreted as the increase in discounted [operating] profits from replacement of inefficient management [and] J can be thought of as research intensity ... . " It seems reasonable to suppose that $Z_t = z * VC_t$, where VC_t is the present value of operating profits as at the date of the takeover t, and that M is also proportional to firm size.

Let Q be the market's subjective probability that such a takeover will take place. Firm value is then

$$V = C + VC - T * DC + Z * J * Q,$$

where DC_t is the present value of dividends as at the date of the takeover t.

The optimal time for the corporation to buy is just before the shares go exdividend, because when they go ex dividend, the share value drops by $D_t * (1 - T)$ but as a corporation, it gets the full dividend value D_t. Firm value just before the ex dividend date can be written as:

$$V' = C' + VC' - T * (D + DC) + Z * J * Q$$

where the primes indicate that the measurement is taking place during a period rather than at the end of it.

The corporation's expected gain is:

$$J * A * [Z + D * T - Z * J * Q] - M(J).$$

Optimum J is determined by:

$$\begin{aligned} A * [Z + D * T] - 2 * A * Z * J^* * Q &= M'(J^*) \\ 2 * A * Z * Q + M''(J^*) &> 0 \end{aligned}$$

To identify the effect of D on J^*, totally differentiate the above first order condition:

$$A * dD * T - 2 * A * Z * dJ^* * Q = M''(J^*)dJ^*.$$

$$\frac{dJ}{dD_t} = \frac{A * T}{2 * A * Z * Q + M''(J^*)} > 0$$

The firm's shareholders want to maximize:

$$V' = C' + VC' - T * [D + DC] + Z * J^*(D) * Q.$$

So the optimum dividend satisfies:

$$\begin{aligned} -T + Z * J^{*\prime}(D^*) * Q &= 0 \\ Z * J^{*\prime}(D^*) * Q &< 0 \end{aligned}$$

Substituting in:

$$T = \frac{Z * Q * A * T}{[2 * A * Z * Q + M''(J^*)]},$$

$$\begin{aligned} M''(J^*(D^*)) &= Z * Q * A - 2 * A * Z * Q \\ &= -Z * Q * A. \end{aligned}$$

So the optimum dividend is a function of Z. If $Z = z * VC$, i.e. the expected improvement is a function of future operating income VC as seems reasonable, then the optimum dividend should also be a function of future operating income.

Appendix B

ADDITIONAL EMPIRICAL EVIDENCE ON VARIATION IN THE EFFECTS OF EARNINGS AND DIVIDEND ANNOUNCEMENTS ON FIRM VALUE

This appendix provides empirical evidence on the earnings and dividend response coefficients supplemental to that in section 2.4. The first subsection uses the same proxies as in section 2.4 and reports firstly, additional tests of hypotheses H1 and H2 using regression and firm and quarter averages, secondly, additional univariate tests of hypotheses H3 to H7 using firm and quarter averages, and thirdly, additional multivariate regression test of the latter hypotheses using firm and quarter averages. The second subsection uses the same proxies, except that it replaces market adjusted returns with raw returns. It reports tests of hypotheses H1 and H2, H3 to H5, and H6 and H7. The results of all the empirical tests are summarized in tables B.1 to B.24.

B.1 Additional tests using market adjusted returns

B.1.1 Signal mitigation

The response coefficients reported in table 2.5 are based on all firm quarters. The tests of the means and the differences in means implicitly assume that the variances are due to random error. The hypotheses suggest that the observations should vary through time and across firms, thus it is possible that the large variances and the differences in the means are due to systematic differences in the quarters or firms that the observations come from. To investigate whether these possible systematic differences are significant, tables B.25 and B.26 pool the observations by firm and quarter.

For each firm, the mean and the median of its observed earnings response coefficients is calculated. The mean of the mean earnings response coefficients is reported in table B.25 as 1.384 which is not significantly different from one (two tail p-value of 40.48%). The median of the median response coefficients is 0.248 which is significantly greater than zero and significantly less than one. Note that in calculating the averages reported in table B.25 each firm's average is given equal weight, regardless of whether it is based on as few as one or as many as 27 quarters.

As in table 2.5, the average response coefficients are significantly greater than zero, except for the averages of the earnings response coefficients when earnings are announced second, and the means of the averages of the dividend response coefficients when dividends are announced less than two weeks after earnings. The average earnings response coefficients are generally not significantly greater than one, but the average dividend response coefficients are, except for the means of the dividend response coefficients when dividends are announced less than two weeks after earnings.

As predicted in hypothesis H2, the mean of the mean earnings response coefficient when earnings are announced first is significantly higher (one tail p-value of 3%) than the mean of the mean earnings response coefficient when earnings are announced second. The mean of the medians is also significantly higher (one tail p-value of 2%). Restricting the tests to those observations where the two announcements are made within two weeks of each other again shows that the average earnings response coefficient is higher when earnings are announced first, but the significance levels are lower (one tail p-value of 11% for means and 25% for medians).

The average dividend response coefficients are larger when dividends are announced first than when dividends are announced second, but the relationship is not significant (one tail p-values are about 30%), contrary to hypothesis H1.

To compute the statistics in table B.26, the average response coefficients of the observations in each quarter were computed. The mean of the 27 mean earnings response coefficients is 1.327 which is not significantly different from one (two-tail p-value of 50%). Again the average response coefficients are significantly greater than zero, except for the averages of the mean earnings response coefficients when earnings are announced after dividends. The averages of the mean earnings response coefficients are not significantly different from one, which is the predicted value for the case when earnings are announced second. However the averages of the median earnings response coefficient are all significantly less than one, contrary to prediction. The averages of the average dividend response coefficients are generally significantly greater than one, as predicted.

The difference between the means of the average earnings response coefficients when earnings are announced first and those when earnings are announced second are positive as predicted, but not significantly so (one tail p-values of about 20%). The difference between the means of the average dividend response coefficients when dividends are announced first and those when dividends are announced second are positive as predicted, but only marginally significantly so (one tail p-values range from 3% for the medians of the announcements made within two weeks of each other to 28% for the means for the unrestricted case).

In summary, the response coefficients are almost always significantly positive, as documented in previous studies. Dividend response coefficients are almost always significantly greater than one, as predicted in hypotheses H1. Some support was obtained for hypothesis H2 that the earnings response coefficient when earnings are announced second should be one, though the median values were generally significantly less than one. Hypothesis H2 that the earnings response coefficient when earnings are announced first should be greater than one was not supported.

The observed earnings response coefficients were generally larger when earnings were announced first than when earnings were announced second as predicted in hypothesis H2, but the difference was often insignificant. Similarly, the observed dividend response coefficients were generally larger when dividends were announced first than when dividends were announced second as predicted in hypothesis H1, but the difference was rarely significant.

The preceding tests of hypotheses H1 and H2 were based on calculating the response coefficients as the ratios of unexpected returns to unexpected earnings or dividends. Response coefficients are more commonly estimated by regressing unexpected returns on unexpected earnings or dividends. As noted early, errors in measuring unexpected earnings and dividends and instability in the expected response coefficients suggests that the regression results will be biased towards zero. Nevertheless, for comparability with prior studies, the following regression results are presented.

Table B.27 reports the results of regressing announcement window market adjusted returns on unexpected earnings and dividends. When the relative timing of the announcements is ignored, an unexpected one dollar increase in earnings per share increases the common share price by 4.1 cents (in excess of the market return) over the two days of the announcement window. Ignoring the timing of the announcements, an unexpected one dollar increase in dividends per share increases the common share price by \$1.793 (in excess of the market return) over the two days of the announcement window. These increases are based on the regression results for all 270 firms and all 27 quarters, except for three firm quarters with missing data. Though the increases are significantly greater than zero, they are lower than predicted and the adjusted R^2s are less than 1%. This may be due to measurement error in the proxy for unexpected earnings and dividends or due to the regression slope being predicted to be different across observations.

Using only the 3403 observations in which the earnings announcement precedes the dividend announcement produces the same increase of 4.1 cents. Using only the 2489 observations[1] in which the earnings announcement follows the dividend announcement produces a response coefficient of 5.4%. Both calculated earnings response coefficients are significantly greater than zero, but are significantly less than one, contrary to hypothesis H2. In addition, the response coefficient when earnings are announced second is larger than when earnings are announced first, also contrary to hypothesis H2. However it should be noted that the slope is predicted to vary across observations for ERC_1 which would bias the regression coefficient towards zero, while the slope is predicted to be 1 for all observations of ERC_2 so that its regression coefficient should be biased downward only due to errors in the proxy for unexpected earnings.

The 1.466 dividend response coefficient when dividends are announced before earnings is lower than the 2.816 response coefficient when dividends are announced after earnings, contrary to hypothesis H1. The prediction is based on the assumption that the two announcements are based on the same information available to firm management. In fact, the observed announcements can differ by several weeks. Table B.28 reports the results of the same regressions when the data is restricted to cases in which the two announcements are made within two weeks of each other. The regression results for these observations support hypotheses H1 and H2 that the response coefficients should be lower when the announcement is the second in the series than when it is first.

Tables B.29 and B.30 report results very similar to those in the preceding two tables. The data used is the same, except that small (less than .0001) unexpected

[1] The remaining 1395 observations represent cases in which the earnings and dividends announcements occur less than two days apart.

earnings and dividends amounts are set to zero since they likely are nonzero only due to rounding errors. Since some of these observations have large returns, the adjustment was made to avoid them having undue influence on the regressions. All subsequent tables report results which use this adjusted data.

As noted above, the response coefficients may be biased to zero because the predicted response coefficients vary across firms and through time. In an attempt to reduce this bias, the regressions were repeated first on a cross sectional basis and then on a time series basis.

Tables B.31 and B.32 report the average results of the 27 cross sectional regressions. Each of these regressions should have less bias than those reported in the previous tables, since the dividend tax rate and the risk free interest rates are not varying, but some bias will remain since the firm specific rates still vary. As predicted, the average response coefficients are larger than the corresponding entries in tables B.29 and B.30 except for a couple of the medians. However, the earnings response coefficients continue to be less than one, contrary to hypothesis H2.

Tables B.33 and B.34 report the average results of the time series regressions. The response coefficients in each of these regressions should have less bias than those in tables B.29 and B.30 since the firm specific rates should not vary, but some bias will remain since the interest rates and tax rates vary through time. The average response coefficients are generally larger than the corresponding entries in tables B.29 and B.30, as predicted. Some of the median response coefficients are lower than in the earlier tables, particularly for the dividend response coefficients. This is due to many of the observations in the sample having no dividend surprises. In addition, some firms have only one dividend announcement preceding (or following) the earnings announcement. In such a case, the regression assigns the amount of the market adjusted return to the intercept, while it would be preferable to set the intercept to zero and report the ratio of the return to the unexpected dividend as the slope. Tables B.35 and B.36 attempt to do this by adding the point (0,0) to each firm's observations. As predicted, in most cases the average intercept is lower and the average response coefficient is higher in these tables than in the corresponding entries of tables B.33 and B.34.

In summary, the regression results indicate that the response coefficients are significantly positive as predicted. At least for the case when the two announcements occur within two weeks of each other, the response coefficients are higher as predicted by hypotheses H1 and H2 when the earnings (dividend) announcement is made first than when it is made second. The dividend response coefficients are generally significantly greater than one, as predicted in hypothesis H1. The earnings response coefficients are generally significantly less than one, contrary to hypothesis H2.

B.1.2 Univariate tests of the variation in the dividend and earnings response coefficients

Hypotheses H3, H4, and H5 predict that the response coefficients should vary among firms depending on the firms' dividend payout rates, betas, and dividend growth rates. Table B.25 reports that the mean payout rate for the 270 firms in the sample was 48.3%, that the mean beta was 0.878, and that the mean dividend growth rate was 1.4%. One quarter of the firms had payout rates less than 36% and one quarter had payout rates greater than 64.1%.

Since only one payout rate is calculated per firm, it may seem more appropriate to compare that rate to one type of response coefficient per firm, namely one of the averages reported in table B.25.

Table B.37 reports results of univariate tests of the relation between the firm rates and the response coefficients. Eight statistical test of each hypothesis are reported. Test results for hypothesis H3c, which predicts that the earnings response coefficient when earnings are announced before dividends should be larger the smaller the dividend payout rate, are reported in the second row.

The first two columns report the results of tests which compare the mean earnings response coefficients when earnings are announced first of firms whose payout rate exceeds 64.1% (that is, their payout rate is in the top quartile of payout rates) with the mean earnings response coefficient when earnings are announced first of firms whose payout rate is less than 36% (that is, their payout rate is in the bottom quartile of payout rates). The first column reports the result of a t test which compares the mean of the mean response coefficients for the first set of firms with the mean of the mean response coefficients for the second set of firms. One can reject the null hypothesis that the means are equal in favour of the alternate that the mean in the first group is lower with 93.8% confidence. The second column reports a Wilcoxon nonparametric test which compares the mean of the ranks of the mean response coefficients of the first set of firms with the mean of the ranks of the mean response coefficients of the second set. Again the null can be rejected: the probability that it holds is 11.3%.

The next two columns report the results of the same statistical tests applied to the median earnings response coefficients when earnings are announced first of the same two sets of firms. Again, the mean and the mean rank of the median response coefficients of the 38 firms with payout rates greater than 64.1% are significantly lower than the mean and the mean rank, respectively, of the median response coefficients of the 53 firms with payout rates less than 36%. Note that 30 of the 68 firms with payout rates greater than 64.1% and 15 of the 68 firms with payout rates less than 36% always announced earnings after dividends.

The final four columns report the results of the same statistical tests for the earnings response coefficients when the earnings announcement precedes the dividend announcement by less than two weeks. Although the difference in the averages still have the predicted sign, the significance levels are much lower. In summary, the eight tests support (with varying levels of significance) hypothesis H3c.

The sixth row reports the results of eight tests of hypothesis H3b. The mean dividend response coefficient, when dividends were announced second, was significantly lower (one tail p-value of 8.6%) as predicted for the 29 firms with payout rate greater than 64.1% than for the 44 firms with payout rates less than 36.0%. Again the results comparing the ranks of the mean response coefficients, or the means or ranks of the median response coefficients are similar, though the significance levels vary somewhat. Again the results are less significant when only the observations in which the announcements are made within two weeks of each other are used. Hypothesis H3b can be accepted.

The average dividend response coefficient, when dividends were announced first, is higher for the 37 firms with payout rates over 64.1% than it is for the 33 firms with payout rates less than 36.0%, contrary to hypothesis H3a. The results when the data are restricted to dividend announcements made less than two weeks before the earnings announcement are insignificant. It is interesting to observe that, when the order of the announcements is ignored, the 66 firms with payout rates over 64.1% have significantly lower dividend response coefficients (one tail p-value of 0.6%) than the 65 firms with payout rates less than 36.0%. The test results for this case are always better than for the two cases when the announcement order is taken into account, possibly because the sample sizes are larger.

The effect on the response coefficients of differences in firms' beta is generally insignificant, contrary to hypothesis H4.

The mean rank of the median earnings response coefficient when earnings are announced first is significantly higher (one tail p-value of 2.7%) as predicted by hypothesis H5c for the 56 firms with dividend growth rates more than 2.4% than for the 54 firms with dividend growth rates less than 0.7%. Similar results are again obtained using means instead of mean ranks or means instead of medians, and when only the data for the announcements made within two weeks of each other is used.

The mean rank of the median dividend response coefficient when dividends are announced second is significantly higher (one tail p-value of 2.0%) as predicted by hypothesis H5b for the 46 firms with dividend growth rates more than 2.4% than for the 38 firms with dividend growth rates less than 0.7%. Similar results obtain again for the other tests of this relation.

The results of comparing the dividend response coefficient when dividends are announced first between the firms with high dividend growth rates and those with low dividend growth rates are not significant, contrary to hypothesis H5a. Interestingly, ignoring the timing of the announcements gives test results which are strongly supportive of the prediction that higher dividend growth rates should be associated with higher dividend response coefficients.

In summary, the observed relations between the payout rate and the growth rate and the earnings response coefficient and the dividend response coefficient when earnings are announced before dividends are as predicted. The observed relations between the two rates and the dividend response coefficient when dividends are announced first are weak. The observed relations between beta and the response coefficient are also weak, contrary to prediction.

Hypotheses H6 and H7 predict that the response coefficients should through time as the risk free interest rate and the effective dividend tax rate vary. Table B.26 reports that the median interest rate for the sample period is 11.12%, with one fourth of the quarters having rates below 9.12% and another fourth having rates above 12.45%. The effective dividend tax rate in 1986 and 1987 is assumed to be lower than in 1981 and 1982.

Table B.38 reports the results of the univariate tests of the predicted relations between the response coefficients and the time series rates. The mean rank of the median earnings response coefficients, when earnings are announced first, in the seven quarters in which the risk free rate exceeded 12.45% is significantly higher (one tail p-value of 8%) than the mean rank of the median response coefficients for the seven quarters in which the risk free rate was less than 9.12%, contrary to prediction. The results of the other tests of this relation are also contrary to hypothesis H6c.

The mean rank of the median dividend response coefficients, when dividends are announced second, in the seven quarters in which the risk free rate exceeded 12.45% is insignificantly lower (one tail p-value of 35%) than the mean rank of the median response coefficients for the seven quarters in which the risk free rate was less than 9.12%. The results of the other tests of this relation are more supportive of hypothesis H6b.

The mean rank of the median dividend response coefficients, when dividends are announced first, in the seven quarters in which the risk free rate exceeded 12.45% is insignificantly lower (one tail p-value of 30%) than the mean rank of the median response coefficients for the seven quarters in which the risk free rate was less than 9.12%. The other tests of this relation also indicate that it is negative as predicted in hypothesis H6a, but not significantly so.

The mean earnings response coefficient, when earnings are announced first, is lower in 1981 and 1982 than the mean response coefficient in 1986 and 1987, but not significantly so (one tail p-value of 18.6%). The median earnings response coefficients are higher in 1981 and 1982 compared to 1986 and 1987, contrary to hypothesis H7c. The mean dividend response coefficient, when dividends are announced after earnings, is significantly lower (one tail p-value of 6.1%) in 1981 and 1982 than in 1986 and 1987, as predicted in hypothesis H7b. Using medians or ranks does not change this result. The mean dividend response coefficient, when dividends are announced first, is insignificantly lower (one tail p-value of 16.7%) in 1981 and 1982 compared to 1986 and 1987. The relation is more significant when only the observations in which the dividend announcement precedes the earnings announcement by less than two weeks are used.

In summary, the test results support the predicted relations between the effective tax rates and the interest rate in the case when dividends are announced after earnings. The data presents evidence contrary to the hypothesis when earnings are announced before dividends. The test results are weakly supportive of the predicted relation between the dividend response coefficient when dividends are announced first and the two rates. It should be noted that interest rates were lower in 1986 and 1987 than they were in 1981 and 1982, so that the test results cannot completely distinguish between hypotheses H6 and H7.

B.1.3 Multiple regression tests of the variation in the dividend and earnings response coefficients

The tests of hypotheses H3, H4, and H5 reported in the previous subsection suffer from two possible weaknesses. First, they use only half the data for each test, since the middle two quartiles for each rate are ignored. Second, they assume that each rate can be examined separately. For instance, if lower risk firms generally have lower growth, then it may not be possible to examine hypotheses H4 and H5 separately since H4 predicts that the lower risk leads to larger response coefficients while H5 predicts that lower growth leads to lower response coefficients. The following tables use the average observations of all the firms and regress the response coefficients on all three of the firm rates.

Table B.39 reports the results for the earnings response coefficients when earnings are announced before dividends. White's χ^2 statistic and the variance inflation factors indicate that the regression equations are well specified. However the R^2s are generally small, particularly for the regressions using the mean response coefficient. Although table B.37 reported a significant univariate relation between the earnings response coefficient and the payout rate, table B.39 reports that the relation is not significant once the other two rates are considered, and in some cases the sign is contrary to hypothesis H3c's prediction. The converse situation occurs with respect to beta. Table B.37 reported no univariate relation between beta and earnings response coefficients, but table B.39 reports a generally significantly negative relation between beta and median earnings response coefficient as predicted by hypothesis H4c, though the relation is not significant for the mean earnings response coefficient. The growth rate is significantly associated with the earnings response coefficient even when the other two rates are considered, as predicted by hypothesis H5c.

Table B.40 reports the results of the regressions of the average dividend response coefficient, when dividends are announced second, on the firm rates. White's χ^2 and the variance inflation factors are again acceptable, but the R^2s are low, particularly for the first two regressions which use the most observations. The significance of the relation between the dividend payout rate and the response coefficient is again much less in the multivariate tests than in the univariate tests. There is weak support for the predicted negative relation between beta and the dividend response coefficient. The growth rate and the response coefficient are generally significantly related, as predicted in hypothesis H5b.

Table B.41 reports the results of regressing the average dividend response coefficient, when dividends are announced first, on the firm rates. Again the regressions involving the mean response coefficients generally have zero adjusted R^2s. There is weak support for the predicted negative relation between the response coefficient and the payout rate. The sign of the regression coefficient on beta is generally negative as predicted, but insignificantly so. There is weak evidence of the predicted positive relation between the growth rate and the response coefficient.

In summary, the evidence presented supports hypothesis H5 which predicts a positive association between the dividend growth rate and the response coefficients. The negative relation predicted by hypothesis H3 between the dividend payout rate and the response coefficients is strongly supported in the univariate tests but very weakly supported in the multivariate tests. The prediction is generally supported for the dividend response coefficient when dividends are announced second, but the evidence is weak for the other two response coefficients. The univariate tests find little relation between beta and the response coefficients; the multivariate test generally find a negative but insignificant relation between them.

Table B.42 reports the results of regressing the average earnings response coefficients on the interest rate. As in table B.38, the mean response coefficient is negatively associated with the interest rate as predicted, but the median response coefficient is positively associated, contrary to hypothesis H6c. Table B.43 reports the results of the regression when the tax rate dummy is included. Here the regression coefficient on the interest rate is almost always positive, contrary to hypothesis H6c, and sometimes significantly so. The regression coefficient on the tax rate dummy is generally positive, as predicted by hypothesis H7c, but the significance level varies.

Table B.44 reports the results of regressing the average dividend response coefficient, when dividends are announced after earnings, on the interest rate. The relation is generally significantly negative, as predicted by hypothesis H6b. When the tax rate dummy is included in the regression (table B.45), the regression coefficient on the interest rate is generally insignificant, and often has the wrong sign. The regression coefficients on the tax rate dummy are also generally insignificant, contrary to hypothesis H7b. The poor significance levels may be due to multicollinearity, as suggest by the high variance inflation factors.

Table B.46 reports the results of regressing the average dividend response coefficient, when dividends are announced before earnings, on the interest rate. The relation is generally significantly negative, as predicted by hypothesis H6a. When the tax rate dummy is included in the regression (table B.47), the regression coefficient on the interest rate is generally insignificantly negative. The regression coefficients on the tax rate are also generally insignificant, contrary to hypothesis H7a.

In summary, the data does not support hypothesis H6c which predicts a negative relation between the earnings response coefficient and the risk free interest rate. The data does provide some support for the predicted relation between the dividend response coefficients and the risk free interest rate, though the support is very weak when the tax rate dummy is included. The relation between the tax rate dummy and the response coefficients is generally in the direction predicted by hypothesis H7, but the relation is often not significant.

It should be recalled that the interest rate was generally higher in 1981 and 1982 than in 1986 and 1987. Thus the tax rate dummy is correlated with interest rates, which is reflected in the magnitude of the variance inflation factors. Moreover, the model would suggest that response coefficients should be lower in 1981 and 1982 than in 1986 and 1987 because both the tax rate and the interest rate were higher in the early years. For this reason, the univariate tests in table B.38 are not necessarily independent, and the multivariate regression results may also be tainted because the tax rate dummy may also be acting as an interest rate dummy.

B.2 Tests using raw returns

B.2.1 Signal mitigation

Table B.48 reports the results of regressing the proxy for changes in firm value on the proxies for unexpected earnings and unexpected dividends. Generally White's test for heteroscedasticity is not significant, implying that the regression is well specified and the error term is homoscedastic. The R^2s are generally less than 1%. This is disappointing, but not surprising given the lack of stability of the regression coefficients across firms and through time.

Regressing returns on unexpected earnings produces an earnings response coefficient of 0.034 which is significantly greater than zero, in agreement with prior studies. The similar regression restricted to the case where the earnings announcement precedes the dividend announcement produces an earnings response coefficient of 0.029, which is barely significant at the 5% level. The regression restricted to the case where earnings are announced after dividends produces an earnings response coefficient of 0.050 which is significantly greater than zero, but significantly less than one, contrary to the predictions of the model. Although it was indicated in the prior subsection that errors in the unexpected earnings proxy could bias the regression coefficient towards zero, these errors should also have lowered the R^2, while the results show a higher R^2 than in most of the regressions.

Regressing returns on unexpected dividends produces a significant dividend response coefficient of 1.81. The dividend response coefficient when dividends are announced first of 1.54 and that when dividends are announced second of 2.09 are both significant. There is no evidence that the latter regression coefficient is biased towards zero, though the regression R^2 is lower than in the preceding two regressions.

The preliminary results pooling the data across firms and through time are disappointing. The R^2s and parameter estimates are much lower than expected. Possible reasons for this are that the independent variables are measured with error and that the response coefficients are not stable across firms and through time. The following tables attempt to address these problems. Table B.49 uses only the observations in which the announcements occur within two weeks of each other, consistent with some previous studies. Table B.50 and all subsequent tables define unexpected dividends or earnings less than 0.0001 in absolute value to be zero, since their small amounts probably arise from rounding errors. Table B.51 imposes the two previous restrictions simultaneously.

Since the model predicts that the response coefficients should vary across time based on time series changes in economy wide variables such as the risk free interest rate and the effective tax rate on dividends, the regressions were run for each quarter separately. Table B.52 reports the averages of the regression coefficients so obtained, and table B.53 reports the averages of the regressions which used only the firm quarters with announcements made within two weeks of each other.

Since the model predicts that the response coefficients should vary across firms based on firm specific characteristics such as their dividend payout and growth rates, the regressions were run for each firm separately. Table B.54 reports the averages of the regression coefficients so obtained, and table B.55 reports the averages of the regressions which used only the firm quarters with announcements made within two weeks of each other. Some of the averages reported in tables B.54 and B.55 are based on regressions with very few observations. In particular, when the regression has only one observation, the response coefficient is set to zero. Since the model suggests that the intercept should be zero, or equivalently that the regression line should go through the origin, the firm specific regressions were rerun with the origin included as one of the data points. The results of this exercise are reported in tables B.56 and B.57.

The average time series earnings response coefficients (in tables B.54, B.55, B.56 and B.57) are higher than the cross section ERCs (in tables B.52 and B.53) which in turn are higher than the pooled ERCs (in tables B.48, B.49, B.50, and B.51). Means are generally higher than medians. Looking specifically at the earnings response coefficient when earnings are announced first, restricting the observations to those in which the dividend announcement follows within two weeks (table B.49), and/or redefining small earnings surprises as zero (tables B.50 and B.51), has little effect: the ERC remains about 3%. The average of the cross sectional ERCs (tables B.52 and B.53) is higher at 10%, but is still much lower than expected. The median time series amounts (tables B.54 and B.55) are not much higher, but the mean results get up into the 50% range. Including the origin in the data (tables B.56 and B.57) finally produces a mean in excess of 100%.

The earnings response coefficient when earnings are announced second presents a similar pattern. This ERC is generally significantly lower than one, contrary to prediction, except in the time series regressions.

The dividend response coefficients are also generally smaller in the pooled regressions than in the time series or cross sectional regressions. Generally the dividend response coefficients when dividends are announced first are larger than when dividends are announced second, as predicted. The time series median dividend response coefficients are generally zero. This reflects the fact that many observations have no dividend surprise; when this is combined with the requirement that dividends be announced specifically before or after dividends, many firms have their only observations consisting of no dividend surprise.

Table B.59 provides additional evidence on the response coefficients. Dividing the two day earnings announcement window return by scaled unexpected earnings gives the earnings response coefficient for each observation; a similar calculation gives the dividend response coefficient. The calculations could provide a maximum of 7290 response coefficients (270 firms times 27 quarters), but response coefficients were not calculated where scaled unexpected earnings or dividends were less than .0001 in absolute value. The 7121 observations with scaled unexpected earnings greater than .0001 in absolute value had a mean value of 1.271 and a median value of 0.110. The 1409 observations with scaled unexpected dividends greater than .0001 in absolute value had a mean value of 11.677 and a median value of 2.894.

All means and medians in table B.59 are greater than zero as predicted. The 2442 earnings response coefficients for the case when earnings are announced after dividends have a mean value of 0.636. Their variance is so large that neither the null hypothesis that the true value is zero nor the null hypothesis that the true value is one can be rejected, even at confidence levels as high as 20%. The 726 earnings response coefficients for the case when earnings are announced up to two weeks after dividends have a mean value of 1.594. Again the null hypothesis that the true value is one cannot be rejected at confidence levels as high as 30%, though the probability that the true value is zero is less than 16%.

The model predicts that the earnings response coefficient will be larger when earnings are announced before dividends than when they are announced after dividends. A one tail t test of the null hypothesis that the two response coefficients are the same is rejected at the 10% level using all the data and at the 12% level for announcements made within two weeks of each other.

The model makes a similar prediction for the dividend response coefficients. Using all the data, the dividend response coefficient is insignificantly higher when dividends are announced first; but using the data for the case when the announcements are made within two weeks of each other indicates that the dividend response coefficient is insignificantly lower when dividends are announced first.

The mean of the 1409 dividend response coefficients calculated ignoring the announcement timing appears higher than the means of the 497 dividend response coefficients when dividends are announced first or the 675 dividend response coefficients when dividends are announced second. However the first calculation includes 237 cases where earnings and dividends are announced within a day of each other but the calculation of the dividend response coefficient assumes that all the returns are due to the dividend announcement.

In summary, the observed response coefficients are positive and generally significantly so, in accordance with the hypotheses and the results of prior research. The magnitudes of the earnings response coefficients obtained in the regressions are much less than predicted. This may be due to the proxy for expected earnings being of low quality and causing an error in variables problem, or to the market not adjusting within two days to the full import of the earnings announcement. The only evidence that supports the model's predictions regarding the relative magnitudes of the earnings response coefficients comes from the upper tail of the distribution of the earnings response coefficient calculated by dividing returns by unexpected earnings. Using this calculation, the earnings response coefficients exceed 50%, and the earnings response coefficient when earnings is announced second is smaller than that when earnings are announced first. The model's prediction that the dividend response coefficient when dividends are announced second should be smaller than when dividends are announced first is generally supported by the regression results.

B.2.2 Tests of cross sectional variation in the response coefficients

Table B.60 provides descriptive statistics for firm rates and response coefficients. The average dividend payout rate for the 270 firms in the sample is 49%, the average beta 0.9, and the average dividend growth rate is 1.4% per quarter.

For each firm, the mean and median of its earnings and dividend response coefficients over the 27 quarters was calculated. The mean of the 270 firms' mean earnings response coefficients is 1.312; the median of the 270 firms' median earnings response coefficients is 0.123. Four firms had no unexpected dividends greater than .0001 in absolute value; for the remaining 266, the mean of their mean dividend response coefficients is 11.784; the median of their median dividend response coefficients is 4.278.

Table B.61 reports the results of regressing the average earnings response coefficient for the case when earnings are announced before dividends on the rates that vary across firms. For instance, regressing the mean earnings response coefficients on the rates for the 201 firms in the sample gives a regression coefficient of 0.047 on the payout ratio, -2.657 on the beta, and 17.316 on the growth rate. None of these coefficients is significant. The White's χ^2 statistics and the largest variance inflation factors indicate that heteroscedasticity and multicollinearity are not significant problems for the regressions in the table. The regressions do not provide much support for the prediction that increase in the dividend payout ratio should reduce the earnings response coefficient, though running the regression in log form on the median ERCs does produce a very significantly negative coefficient. The regression coefficient on beta is generally negative as predicted, but significantly so in only three regressions. The regression coefficient on the dividend growth rate is almost always significantly positive as predicted.

Table B.64 reports the results of comparing the cross sectional variation in the response coefficients after ranking the observations by the firm rates. The first row of the table reports the results of comparing the average earnings response coefficients for the firms in the lowest dividend payout rate quartile with those in the highest payout rate quartile. Using the mean of the 270 firms' earnings response coefficients for the test indicates that the null hypothesis that the mean of the means is the same in both quartiles can be rejected in favour of the alternate that the mean is higher in the lower quartile at the 0.1% level. For the same data, the null hypothesis that the mean rank is the same in both quartiles can also be rejected at the 0.1% level. Using the median of the 270 firms' earnings response coefficients in the two tests produces similar results. Limiting the observations to those in which the announcements are made within two weeks of each other produces somewhat weaker results.

The second row of table B.64 provides some additional support for the prediction that higher dividend payout rates produce lower earnings response coefficients, when earnings are announced before dividends. The tests on the median earnings response coefficients of the full data are particularly supportive; the tests on the data for the announcements within two weeks of each other are not significant. The eighth row of the table indicates that the mean or mean rank earnings response coefficient in the lower beta quartile is generally higher than in the upper quartile but not significantly so. The fourteenth row indicates that higher dividend growth rates are usually associated with higher earnings response coefficients as predicted, though the significance of the results is not high.

Table B.62 reports the results of regressing the average dividend response coefficients on the firm rates, for the case where the dividend announcement precedes the earnings announcement. The regression coefficients on the dividend payout rates are negative and generally significantly so, as predicted. The regression coefficients on the firms' betas are generally negative as predicted, but not significantly so. The regression coefficients on the dividend growth rates are positive as predicted, and about half are significantly positive.

Table B.64 reports the results of the tests of the cross sectional variation in the dividend response coefficients for the case when dividends are announced before earnings by comparing the mean or mean rank of the average DRC in the lowest quartile to that in the highest quartile. Row five indicates that ranking the firms by dividend payout rates has little effect on the dividend response coefficients, contrary to prediction. Rows eleven and seventeen indicate similarly little effect of ranking by firm beta or growth rate.

Table B.63 reports the results of regressing the average dividend response coefficients on the firm rates, for the case when dividends are announced after earnings. The regression coefficient on the dividend payout rates are negative as predicted, though significantly so only when the regression is performed on the data after taking logarithms. The regression coefficients on the betas are generally negative as predicted, but rarely significantly so. The regression coefficients on the dividend growth rates are significantly positive as predicted.

Table B.64 reports the results of the tests of the cross sectional variation in the dividend response coefficients for the case when dividends are announced after earnings by comparing the mean or mean rank of the average DRC in the lowest quartile to that in the highest quartile. Row six provides some support for the hypothesis that higher payout rates are associated with lower dividend response coefficients. Row twelve suggests that firm betas do not significantly affect dividend response coefficients, contrary to prediction. The last row indicates that higher dividend growth rates are significantly associated with higher dividends response coefficients, as predicted.

B.2.3 Tests of times series variation in the response coefficients

Table B.65 provides descriptive statistics on interest rates and response coefficients for the 27 quarters beginning with the second quarter of 1981 and ending with the fourth quarter of 1987. The interest rates are the quarter end constant maturity market yields on 10 year government securities. The mean rate is 11%, the lowest rate of 7.62% occurred in March 1987, and the highest rate of 15.07% occurred in September 1981.

The response coefficient averages in table B.65 are positive as predicted. The mean values generally fall between the median and the third quartile, indicating the distributions are skewed to the left. The 27 mean earnings response coefficients for the case where earnings are announced before dividends have a mean of 1.766. The one tail probability that the true mean is zero is 8.8%. The mean of the mean earnings response coefficients for the case when earnings are announced after dividends is 0.702, which is not significantly different from either zero or one. The mean of the mean earnings response coefficients for the case when earnings are announced up to two weeks before dividends is 2.866. The one tail probability that the true mean is one is less than 10%. The mean of the mean earnings response coefficients for the case when earnings are announced up to two weeks after dividends is 2.042. The one tail probability that the true mean is one cannot be rejected even at probability levels as high as 25%.

The model predicts that the earnings response coefficient will be larger when earnings are announced before dividends than when they are announced after dividends. A one tail t test of the null hypothesis that the two response coefficient are the same can be rejected at the 12% level using all the data; however it cannot be rejected at the 15% level for the case when the announcements are made within two weeks of each other.

The means of the mean dividend response coefficients are all significantly greater than one as predicted. The model predicts that the dividend response coefficient will be larger when dividends are announced before earnings than when they are announced after earnings. A one tail t test of the null hypothesis that the two response coefficient are the same can be rejected at the 15% level using all the data or using the data for the case when the announcements are made within two weeks of each other.

Tables B.66, B.67, and B.68 report the results of regressing the average response coefficients on the risk free interest rate. Table B.66 indicates that increases in the interest rate generally lower the mean earnings response coefficient as predicted, but the coefficients are generally not significant. The regression coefficients for the median earnings response coefficient are mostly positive, contrary to prediction, though they are not significantly greater than zero. Note also that the R^2s are generally very low. Tables B.67 and B.68 provide strong support for the prediction that higher interest rates are associated with lower dividend response coefficients, regardless of the order of the announcements.

Table B.69 reports the results of the rank tests of the time series variations in the response coefficients. The second row again indicates that there is not a consistent relation between the interest rates and the earnings response coefficients when earnings are announced first, contrary to prediction. The fifth and sixth rows provide additional support for the prediction that the dividend response coefficients decline as interest rates increase.

The test of the hypothesis that the response coefficients increase when the effective tax rate on dividends decreases is not powerful. The effective tax rate on dividends decreased as a result of the 1986 tax reform, so that response coefficients should have been higher in the later years in the sample. Unfortunately, interest rates also decreased over the sample, so that the two effects are reinforcing. To test the prediction, the middle 11 quarters in the sample were dropped, so that the reduced sample consisted of quarters 81:2 to 83:1 and 86:1 to 87:4 with the tax rate dummy variable set to zero in the first period and one in the second. However it should be noted that interest rates ranged from 10.62% to 15.07% in the first period but from 7.62% to 9.58% in the last period, so that the dummy may also be capturing this difference in interest rates.

Table B.70 reports the results of regressing the earnings response coefficient for the case when earnings are announced before dividends on interest rates and the tax rate dummy. The regression coefficients on the tax rate dummy are generally significantly positive as predicted. The interest rate coefficient is positive, contrary to prediction.

Table B.71 reports the results of regressing the dividend response coefficient for the case when dividends are announced before earnings on interest rates and the tax rate dummy for up to 16 observations. The regression coefficients on the tax rate dummy are generally significantly positive as predicted. The interest rate coefficient is generally negative using all the data, but generally positive when the data is restricted to announcements being within two weeks of each other, contrary to prediction. Note also that the variance inflation factors suggest that multicollinearity is a problem for the last four regressions.

Table B.72 reports the results of regressing the dividend response coefficient for the case when dividends are announced after earnings on interest rates and the tax rate dummy. The regression coefficients on the tax rate dummy are generally positive as predicted, though significant so only for the log regressions in the case where announcements are made within two weeks of each other. The interest rate coefficient is positive about half the time, contrary to prediction. Note also that the variance inflation factors suggest that multicollinearity is a problem for the regressions which use the 10 observations for the case when the announcements are made within two weeks of each other and the median dividend response coefficients are positive.

The lower half of table B.69 reports the results of comparing response coefficients in 1981 and 1982 to those in 1986 and 1987. Although the later years have lower tax rates, they also are characterized by lower interest rates, so that the results obtained may be due to either cause. The results for the earnings response coefficients when earnings are announced first are not significant. The results for the dividend response coefficients are almost always significant.

In summary, the tests provide strong support for the prediction that larger dividend growth rates are associated with larger response coefficients. The evidence on the effect of the dividend payout rate on the response coefficients weakly supports the predicted inverse relation with the most supportive evidence being obtained for the dividend response coefficient when it follows earnings. Firm betas generally have insignificant effects on the response coefficients, contrary to prediction. Quarters with higher interest rates or higher effective tax rates on dividends exhibit larger response coefficients, particularly dividend response coefficients. However, given that the two effects reinforce each other, it is not completely clear whether they would be individually significant.

Table B.1: Summary of empirical evidence, hypothesis H1, $DRC_1 > 1$

Statistical test	Data type	Market adjusted returns All[1]		Market adjusted returns Two weeks[2]		Raw returns All[1]		Raw returns Two weeks[2]	
Ratios									
Mean		2.5:	.0005	2.5:	.0055	B.59:	.0007	B.59:	.0864
Median		2.5:	.0001	2.5:	.0055	B.59:	.0016	B.59:	.8184
Mean	of mean firm rates	B.25:	.0020	B.25:	.0104	B.60:	.0049	B.60:	.1547
Median	of mean firm rates	B.25:	.0001	B.25:	.0338	B.60:	.0022	B.60:	.6819
Mean	of median firm rates	B.25:	.0022	B.25:	.0171	B.60:	.0094	B.60:	.3129
Median	of median firm rates	B.25:	.0004	B.25:	.0579	B.60:	.0127	B.60:	.5636
Mean	of mean quarter rates	B.26:	.0048	B.26:	.0087	B.65:	.0059	B.65:	.0307
Median	of mean quarter rates	B.26:	.0048	B.26:	.0136	B.65:	.0066	B.65:	.1306
Mean	of median quarter rates	B.26:	.0080	B.26:	.0099	B.65:	.0111	B.65:	.0449
Median	of median quarter rates	B.26:	.0024	B.26:	.0019	B.65:	.0104	B.65:	.7647

Notes:
For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.2: Summary of empirical evidence, hypothesis H1, $DRC_2 > 1$

Data type		Market adjusted returns				Raw returns			
Statistical test		All[1]		Two weeks[2]		All[1]		Two weeks[2]	
Ratios									
Mean		2.5:	.0070	2.5:	.0678	B.59:	.0070	B.59:	.0452
Median		2.5:	.0124	2.5:	.0762	B.59:	.9504	B.59:	.8596
Mean	of mean firm rates	B.25:	.0438	B.25:	.2528	B.60:	.0269	B.60:	.1452
Median	of mean firm rates	B.25:	.0013	B.25:	.0633	B.60:	.0014	B.60:	.0230
Mean	of median firm rates	B.25:	.0619	B.25:	.2446	B.60:	.0288	B.60:	.1440
Median	of median firm rates	B.25:	.0029	B.25:	.0219	B.60:	.0041	B.60:	.0146
Mean	of mean quarter rates	B.26:	.0223	B.26:	.0831	B.65:	.0167	B.65:	.0527
Median	of mean quarter rates	B.26:	.0206	B.26:	.0631	B.65:	.0206	B.65:	.0571
Mean	of median quarter rates	B.26:	.0891	B.26:	.0660	B.65:	.2300	B.65:	.2027
Median	of median quarter rates	B.26:	.1089	B.26:	.0297	B.65:	.6884	B.65:	.5644

Notes:
For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.3: Summary of empirical evidence, hypothesis H2, $ERC_1 > 1$

Statistical test	Data type	Market adjusted returns All[1]		Market adjusted returns Two weeks[2]		Raw returns All[1]		Raw returns Two weeks[2]	
Ratios									
Mean		2.5:	.1610	2.5:	.0348	B.59:	.1820	B.59:	.0404
Median		2.5:	.9999	2.5:	.9996	B.59:	.9999	B.59:	.9999
Mean	of mean firm rates	B.25:	.1320	B.25:	.2758	B.60:	.1573	B.60:	.3172
Median	of mean firm rates	B.25:	.6899	B.25:	.8011	B.60:	.5678	B.60:	.5664
Mean	of median firm rates	B.25:	.1924	B.25:	.3651	B.60:	.2848	B.60:	.6902
Median	of median firm rates	B.25:	.9999	B.25:	.9999	B.60:	.9999	B.60:	.9999
Mean	of mean quarter rates	B.26:	.1742	B.26:	.0659	B.65:	.2760	B.65:	.1308
Median	of mean quarter rates	B.26:	.2870	B.26:	.0838	B.65:	.5465	B.65:	.1986
Mean	of median quarter rates	B.26:	.9999	B.26:	.9999	B.65:	.9999	B.65:	.9999
Median	of median quarter rates	B.26:	.9999	B.26:	.9999	B.65:	.9999	B.65:	.9999

Notes:
For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.4: Summary of empirical evidence, hypothesis H2, $ERC_2 = 1$

Statistical test	Data type	Market adjusted returns: All[1]		Market adjusted returns: Two weeks[2]		Raw returns: All[1]		Raw returns: Two weeks[2]	
Ratios									
Mean		2.5:	.5681	2.5:	.8438	B.59:	.6857	B.59:	.7090
Median		2.5:	.0001	2.5:	.0001	B.59:	.0001	B.59:	.0001
Mean	of mean firm rates	B.25:	.1276	B.25:	.2620	B.60:	.2919	B.60:	.8965
Median	of mean firm rates	B.25:	.0119	B.25:	.0727	B.60:	.0175	B.60:	.3285
Mean	of median firm rates	B.25:	.0241	B.25:	.5697	B.60:	.0542	B.60:	.5417
Median	of median firm rates	B.25:	.0001	B.25:	.0003	B.60:	.0001	B.60:	.0001
Mean	of mean quarter rates	B.26:	.5630	B.26:	.9793	B.65:	.6981	B.65:	.5426
Median	of mean quarter rates	B.26:	.3972	B.26:	.6567	B.65:	.6231	B.65:	.6737
Mean	of median quarter rates	B.26:	.0001	B.26:	.0001	B.65:	.0001	B.65:	.0001
Median	of median quarter rates	B.26:	.0001	B.26:	.0001	B.65:	.0001	B.65:	.0001

Notes:
For each data type and statistical test, this table gives the table reference and the two tail probability of observing the data obtained, given the hypothesis that $ERC_2 = 1$.
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.5: Summary of empirical evidence, hypothesis H1, $DRC_1 > DRC_2$

Data type / Statistical test		Market adjusted returns: All[1]		Two weeks[2]	
Ratios					
Mean		2.5:	.41	2.5:	.27
Mean	of mean firm rates	B.25:	.28	B.25:	.32
Mean	of median firm rates	B.25:	.22	B.25:	.32
Mean	of mean quarter rates	B.26:	.28	B.26:	.12
Mean	of median quarter rates	B.26:	.18	B.26:	.03

Notes:

For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.

[1] Uses all the data.

[2] Uses observations with announcements within two weeks of each other only.

Table B.6: Summary of empirical evidence, hypothesis H2, $ERC_1 > ERC_2$

Data type Statistical test		Market adjusted returns All[1]		Two weeks[2]	
Ratios					
Mean		2.5:	.14	2.5:	.12
Mean	of mean firm rates	B.25:	.03	B.25:	.11
Mean	of median firm rates	B.25:	.02	B.25:	.25
Mean	of mean quarter rates	B.26:	.13	B.26:	.19
Mean	of median quarter rates	B.26:	.21	B.26:	.27

Notes:

For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.

[1] Uses all the data.

[2] Uses observations with announcements within two weeks of each other only.

Table B.7: Summary of empirical evidence, hypothesis H3a, $\frac{\partial\phi(\mathrm{DRC}_1)}{\partial d} < 0$

Statistical test / Data type	Market adjusted returns: All[1]		Market adjusted returns: Two weeks[2]		Raw returns: All[1]		Raw returns: Two weeks[2]	
Comparison of quartiles								
All data								
t test	2.6:	.332	2.6:	.251				
W test	2.6:	.317	2.6:	.409				
Mean of each firm's DRCs								
t test	B.37:	.813	B.37:	.304	B.64:	.778	B.64:	.436
W test	B.37:	.607	B.37:	.536	B.64:	.833	B.64:	.864
Median of each firm's DRCs								
t test	B.37:	.840	B.37:	.280	B.64:	.786	B.64:	.394
W test	B.37:	.734	B.37:	.550	B.64:	.843	B.64:	.912
Regression results								
All data								
Including rates r, β, g								
All data	2.9:	.297	2.9:	.286				
Positive DRCs only	2.9:	.320	2.9:	.057				
Log model	2.9:	.194	2.9:	.038				
Including firm rates β, g								
All data	2.9:	.286	2.9:	.222				
Positive DRCs only	2.9:	.266	2.9:	.049				
Log model	2.9:	.161	2.9:	.030				
Including all rates r, T, β, g								
All data	2.9:	.358	2.9:	.342				
Positive DRCs only	2.9:	.648	2.9:	.670				
Log model	2.9:	.361	2.9:	.792				
Mean of each firm's DRCs								
Including firm rates β, g								
All data	B.41:	.213	B.41:	.126	B.62:	.232	B.62:	.120
Positive DRCs only	B.41:	.327	B.41:	.052	B.62:	.219	B.62:	.063
Log model	B.41:	.264	B.41:	.148	B.62:	.050	B.62:	.012
Median of each firm's DRCs								
Including firm rates β, g								
All data	B.41:	.207	B.41:	.141	B.62:	.220	B.62:	.116
Positive DRCs only	B.41:	.342	B.41:	.051	B.62:	.260	B.62:	.012
Log model	B.41:	.287	B.41:	.034	B.62:	.059	B.62:	.005

Notes:

For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.

[1] Uses all the data.

[2] Uses observations with announcements within two weeks of each other only.

Table B.8: Summary of empirical evidence, hypothesis H3b, $\frac{\partial\phi(\mathrm{DRC}_2)}{\partial d} < 0$

Data type / Statistical test	Market adjusted returns: All[1]		Market adjusted returns: Two weeks[2]		Raw returns: All[1]		Raw returns: Two weeks[2]	
Comparison of quartiles								
All data								
t test	2.6:	.069	2.6:	.194				
W test	2.6:	.269	2.6:	.276				
Mean of each firm's DRCs								
t test	B.37:	.086	B.37:	.256	B.64:	.049	B.64:	.196
W test	B.37:	.013	B.37:	.097	B.64:	.013	B.64:	.075
Median of each firm's DRCs								
t test	B.37:	.160	B.37:	.328	B.64:	.193	B.64:	.406
W test	B.37:	.138	B.37:	.151	B.64:	.288	B.64:	.420
Regression results								
All data								
Including rates r, β, g								
All data	2.11:	.697	2.11:	.626				
Positive DRCs only	2.11:	.082	2.11:	.200				
Log model	2.11:	.006	2.11:	.043				
Including firm rates β, g								
All data	2.11:	.668	2.11:	.612				
Positive DRCs only	2.11:	.062	2.11:	.172				
Log model	2.11:	.004	2.11:	.038				
Including all rates r, T, β, g								
All data	2.11:	.566	2.11:	.539				
Positive DRCs only	2.11:	.238	2.11:	.316				
Log model	2.11:	.010	2.11:	.033				
Mean of each firm's DRCs								
Including firm rates β, g								
All data	B.40:	.269	B.40:	.317	B.63:	.222	B.63:	.231
Positive DRCs only	B.40:	.098	B.40:	.103	B.63:	.159	B.63:	.108
Log model	B.40:	.012	B.40:	.010	B.63:	.045	B.63:	.035
Median of each firm's DRCs								
Including firm rates β, g								
All data	B.40:	.299	B.40:	.410	B.63:	.384	B.63:	.446
Positive DRCs only	B.40:	.134	B.40:	.228	B.63:	.168	B.63:	.147
Log model	B.40:	.141	B.40:	.187	B.63:	.088	B.63:	.108

Notes:
For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.9: Summary of empirical evidence, hypothesis H3c, $\frac{\partial\phi(\text{ERC}_1)}{\partial d} < 0$

Statistical test \ Data type	Market adjusted returns All[1]		Market adjusted returns Two weeks[2]		Raw returns All[1]		Raw returns Two weeks[2]	
Comparison of quartiles								
All data								
t test	2.6:	.094	2.6:	.034				
W test	2.6:	.000	2.6:	.010				
Mean of each firm's ERCs								
t test	B.37:	.062	B.37:	.261	B.64:	.075	B.64:	.313
W test	B.37:	.113	B.37:	.114	B.64:	.180	B.64:	.125
Median of each firm's ERCs								
t test	B.37:	.069	B.37:	.453	B.64:	.035	B.64:	.762
W test	B.37:	.009	B.37:	.096	B.64:	.019	B.64:	.221
Regression results								
All data								
Including r, β, g								
All data	2.13:	.551	2.13:	.593				
Positive ERCs only	2.13:	.504	2.13:	.494				
Log model	2.13:	.969	2.13:	.989				
Including firm rates β, g								
All data	2.13:	.556	2.13:	.584				
Positive ERCs only	2.13:	.487	2.13:	.463				
Log model	2.13:	.968	2.13:	.989				
Including all rates r, T, β, g								
All data	2.13:	.564	2.13:	.601				
Positive ERCs only	2.13:	.518	2.13:	.544				
Log model	2.13:	.984	2.13:	.992				
Mean of each firm's ERCs								
Including firm rates β, g								
All data	B.39:	.499	B.39:	.580	B.61:	.528	B.61:	.583
Positive ERCs only	B.39:	.441	B.39:	.514	B.61:	.514	B.61:	.420
Log model	B.39:	.884	B.39:	.743	B.61:	.866	B.61:	.808
Median of each firm's ERCs								
Including firm rates β, g								
All data	B.39:	.453	B.39:	.584	B.61:	.441	B.61:	.587
Positive ERCs only	B.39:	.534	B.39:	.606	B.61:	.234	B.61:	.244
Log model	B.39:	.582	B.39:	.653	B.61:	.004	B.61:	.004

Notes:
For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.10: Summary of empirical evidence, hypothesis H4a, $\frac{\partial\phi(\mathrm{DRC}_1)}{\partial\beta} < 0$

Data type / Statistical test	Market adjusted returns All[1]		Market adjusted returns Two weeks[2]		Raw returns All[1]		Raw returns Two weeks[2]	
Comparison of quartiles								
All data								
t test	2.6:	.387	2.6:	.077				
W test	2.6:	.360	2.6:	.299				
Mean of each firm's DRCs								
t test	B.37:	.566	B.37:	.164	B.64:	.510	B.64:	.132
W test	B.37:	.549	B.37:	.289	B.64:	.497	B.64:	.149
Median of each firm's DRCs								
t test	B.37:	.277	B.37:	.251	B.64:	.328	B.64:	.149
W test	B.37:	.364	B.37:	.431	B.64:	.254	B.64:	.289
Regression results								
All data								
Including rates r, d, g								
All data	2.9:	.460	2.9:	.189				
Positive DRCs only	2.9:	.234	2.9:	.127				
Log model	2.9:	.212	2.9:	.211				
Including firm rates d, g								
All data	2.9:	.463	2.9:	.227				
Positive DRCs only	2.9:	.208	2.9:	.159				
Log model	2.9:	.186	2.9:	.253				
Including all rates r, T, d, g								
All data	2.9:	.604	2.9:	.551				
Positive DRCs only	2.9:	.562	2.9:	.674				
Log model	2.9:	.398	2.9:	.913				
Mean of each firm's DRCs								
Including firm rates d, g								
All data	B.41:	.312	B.41:	.327	B.62:	.464	B.62:	.422
Positive DRCs only	B.41:	.306	B.41:	.050	B.62:	.546	B.62:	.374
Log model	B.41:	.324	B.41:	.258	B.62:	.197	B.62:	.413
Median of each firm's DRCs								
Including firm rates d, g								
All data	B.41:	.223	B.41:	.419	B.62:	.371	B.62:	.384
Positive DRCs only	B.41:	.486	B.41:	.186	B.62:	.787	B.62:	.162
Log model	B.41:	.654	B.41:	.313	B.62:	.909	B.62:	.483

Notes:
For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.11: Summary of empirical evidence, hypothesis H4b, $\frac{\partial\phi(\mathrm{DRC}_2)}{\partial\beta} < 0$

Statistical test \ Data type	Market adjusted returns: All[1]		Market adjusted returns: Two weeks[2]		Raw returns: All[1]		Raw returns: Two weeks[2]	
Comparison of quartiles								
All data								
t test	2.6:	.894	2.6:	.620				
W test	2.6:	.606	2.6:	.308				
Mean of each firm's DRCs								
t test	B.37:	.876	B.37:	.451	B.64:	.887	B.64:	.426
W test	B.37:	.874	B.37:	.322	B.64:	.793	B.64:	.270
Median of each firm's DRCs								
t test	B.37:	.804	B.37:	.414	B.64:	.863	B.64:	.435
W test	B.37:	.659	B.37:	.223	B.64:	.466	B.64:	.109
Regression results								
All data								
Including rates r, d, g								
All data	2.11:	.758	2.11:	.410				
Positive DRCs only	2.11:	.576	2.11:	.333				
Log model	2.11:	.028	2.11:	.066				
Including firm rates d, g								
All data	2.11:	.740	2.11:	.371				
Positive DRCs only	2.11:	.534	2.11:	.246				
Log model	2.11:	.033	2.11:	.050				
Including all rates r, T, d, g								
All data	2.11:	.553	2.11:	.439				
Positive DRCs only	2.11:	.578	2.11:	.392				
Log model	2.11:	.036	2.11:	.074				
Mean of each firm's DRCs								
Including firm rates d, g								
All data	B.40:	.526	B.40:	.142	B.63:	.514	B.63:	.126
Positive DRCs only	B.40:	.282	B.40:	.104	B.63:	.450	B.63:	.150
Log model	B.40:	.312	B.40:	.019	B.63:	.564	B.63:	.119
Median of each firm's DRCs								
Including firm rates d, g								
All data	B.40:	.433	B.40:	.140	B.63:	.536	B.63:	.157
Positive DRCs only	B.40:	.237	B.40:	.169	B.63:	.330	B.63:	.157
Log model	B.40:	.396	B.40:	.213	B.63:	.169	B.63:	.058

Notes:
For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.12: Summary of empirical evidence, hypothesis H4c, $\frac{\partial\phi(\mathrm{ERC}_1)}{\partial\beta} < 0$

Data type / Statistical test	Market adjusted returns All[1]		Market adjusted returns Two weeks[2]		Raw returns All[1]		Raw returns Two weeks[2]	
Comparison of quartiles								
All data								
t test	2.6:	.260	2.6:	.626				
W test	2.6:	.406	2.6:	.517				
Mean of each firm's ERCs								
t test	B.37:	.174	B.37:	.263	B.64:	.138	B.64:	.231
W test	B.37:	.542	B.37:	.681	B.64:	.401	B.64:	.699
Median of each firm's ERCs								
t test	B.37:	.103	B.37:	.091	B.64:	.128	B.64:	.069
W test	B.37:	.334	B.37:	.644	B.64:	.535	B.64:	.536
Regression results								
All data								
Including rates r, d, g								
All data	2.13:	.610	2.13:	.767				
Positive ERCs only	2.13:	.779	2.13:	.762				
Log model	2.13:	.994	2.13:	.973				
Including firm rates d, g								
All data	2.13:	.614	2.13:	.764				
Positive ERCs only	2.13:	.781	2.13:	.739				
Log model	2.13:	.994	2.13:	.971				
Including all rates r, T, d, g								
All data	2.13:	.831	2.13:	.858				
Positive ERCs only	2.13:	.832	2.13:	.857				
Log model	2.13:	.997	2.13:	.957				
Mean of each firm's ERCs								
Including firm rates d, g								
All data	B.39:	.148	B.39:	.350	B.61:	.222	B.61:	.398
Positive ERCs only	B.39:	.206	B.39:	.227	B.61:	.411	B.61:	.488
Log model	B.39:	.831	B.39:	.627	B.61:	.816	B.61:	.827
Median of each firm's ERCs								
Including firm rates d, g								
All data	B.39:	.016	B.39:	.043	B.61:	.023	B.61:	.036
Positive ERCs only	B.39:	.016	B.39:	.008	B.61:	.014	B.61:	.004
Log model	B.39:	.726	B.39:	.482	B.61:	.748	B.61:	.194

Notes:
For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.13: Summary of empirical evidence, hypothesis H5a, $\frac{\partial\phi(\mathrm{DRC}_1)}{\partial g} > 0$

Data type / Statistical test	Market adjusted returns All[1]		Market adjusted returns Two weeks[2]		Raw returns All[1]		Raw returns Two weeks[2]	
Comparison of quartiles								
All data								
t test	2.6:	.060	2.6:	.202				
W test	2.6:	.091	2.6:	.334				
Mean of each firm's DRCs								
t test	B.37:	.325	B.37:	.403	B.64:	.196	B.64:	.346
W test	B.37:	.177	B.37:	.531	B.64:	.282	B.64:	.500
Median of each firm's DRCs								
t test	B.37:	.453	B.37:	.364	B.64:	.281	B.64:	.465
W test	B.37:	.511	B.37:	.591	B.64:	.496	B.64:	.705
Regression results								
All data								
Including rates r, β, d								
All data	2.9:	.093	2.9:	.224				
Positive DRCs only	2.9:	.006	2.9:	.202				
Log model	2.9:	.001	2.9:	.187				
Including firm rates d, β								
All data	2.9:	.088	2.9:	.146				
Positive DRCs only	2.9:	.006	2.9:	.141				
Log model	2.9:	.001	2.9:	.124				
Including all rates r, T, d, β								
All data	2.9:	.179	2.9:	.517				
Positive DRCs only	2.9:	.028	2.9:	.187				
Log model	2.9:	.036	2.9:	.183				
Mean of each firm's DRCs								
Including firm rates d, β								
All data	B.41:	.246	B.41:	.262	B.62:	.186	B.62:	.282
Positive DRCs only	B.41:	.179	B.41:	.196	B.62:	.035	B.62:	.055
Log model	B.41:	.094	B.41:	.456	B.62:	.054	B.62:	.387
Median of each firm's DRCs								
Including firm rates d, β								
All data	B.41:	.366	B.41:	.249	B.62:	.260	B.62:	.373
Positive DRCs only	B.41:	.100	B.41:	.282	B.62:	.038	B.62:	.049
Log model	B.41:	.126	B.41:	.211	B.62:	.192	B.62:	.410

Notes:
For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.14: Summary of empirical evidence, hypothesis H5b, $\frac{\partial\phi(\mathrm{DRC}_2)}{\partial g} > 0$

Data type / Statistical test	Market adjusted returns All[1]		Market adjusted returns Two weeks[2]		Raw returns All[1]		Raw returns Two weeks[2]	
Comparison of quartiles								
All data								
t test	2.6:	.029	2.6:	.061				
W test	2.6:	.038	2.6:	.070				
Mean of each firm's DRCs								
t test	B.37:	.064	B.37:	.014	B.64:	.077	B.64:	.029
W test	B.37:	.033	B.37:	.018	B.64:	.036	B.64:	.054
Median of each firm's DRCs								
t test	B.37:	.064	B.37:	.008	B.64:	.049	B.64:	.009
W test	B.37:	.020	B.37:	.004	B.64:	.034	B.64:	.031
Regression results								
All data								
Including rates r, d, β								
All data	2.11:	.039	2.11:	.077				
Positive DRCs only	2.11:	.001	2.11:	.047				
Log model	2.11:	.000	2.11:	.034				
Including firm rates d, β								
All data	2.11:	.031	2.11:	.056				
Positive DRCs only	2.11:	.000	2.11:	.021				
Log model	2.11:	.000	2.11:	.014				
Including all rates r, T, d, β								
All data	2.11:	.049	2.11:	.056				
Positive DRCs only	2.11:	.008	2.11:	.080				
Log model	2.11:	.009	2.11:	.170				
Mean of each firm's DRCs								
Including firm rates d, β								
All data	B.40:	.184	B.40:	.063	B.63:	.168	B.63:	.090
Positive DRCs only	B.40:	.019	B.40:	.011	B.63:	.012	B.63:	.026
Log model	B.40:	.067	B.40:	.037	B.63:	.002	B.63:	.012
Median of each firm's DRCs								
Including firm rates d, β								
All data	B.40:	.249	B.40:	.047	B.63:	.104	B.63:	.036
Positive DRCs only	B.40:	.043	B.40:	.008	B.63:	.009	B.63:	.008
Log model	B.40:	.008	B.40:	.029	B.63:	.012	B.63:	.023

Notes:
For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.15: Summary of empirical evidence, hypothesis H5c, $\frac{\partial\phi(\mathrm{ERC}_1)}{\partial g} > 0$

Data type / Statistical test	Market adjusted returns All[1]		Market adjusted returns Two weeks[2]		Raw returns All[1]		Raw returns Two weeks[2]	
Comparison of quartiles								
All data								
t test	2.6:	.044	2.6:	.004				
W test	2.6:	.000	2.6:	.000				
Mean of each firm's ERCs								
t test	B.37:	.047	B.37:	.064	B.64:	.194	B.64:	.352
W test	B.37:	.014	B.37:	.009	B.64:	.173	B.64:	.118
Median of each firm's ERCs								
t test	B.37:	.052	B.37:	.112	B.64:	.172	B.64:	.479
W test	B.37:	.027	B.37:	.073	B.64:	.077	B.64:	.118
Regression results								
All data								
Including rates r, d, β								
All data	2.13:	.166	2.13:	.083				
Positive ERCs only	2.13:	.000	2.13:	.003				
Log model	2.13:	.000	2.13:	.000				
Including firm rates d, β								
All data	2.13:	.166	2.13:	.083				
Positive ERCs only	2.13:	.000	2.13:	.003				
Log model	2.13:	.000	2.13:	.000				
Including all rates r, T, d, β								
All data	2.13:	.144	2.13:	.241				
Positive ERCs only	2.13:	.008	2.13:	.117				
Log model	2.13:	.000	2.13:	.000				
Mean of each firm's ERCs								
Including firm rates d, β								
All data	B.39:	.161	B.39:	.121	B.61:	.400	B.61:	.374
Positive ERCs only	B.39:	.057	B.39:	.053	B.61:	.053	B.61:	.012
Log model	B.39:	.009	B.39:	.103	B.61:	.002	B.61:	.001
Median of each firm's ERCs								
Including firm rates d, β								
All data	B.39:	.103	B.39:	.112	B.61:	.154	B.61:	.511
Positive ERCs only	B.39:	.061	B.39:	.009	B.61:	.077	B.61:	.042
Log model	B.39:	.000	B.39:	.000	B.61:	.000	B.61:	.000

Notes:

For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.

[1] Uses all the data.

[2] Uses observations with announcements within two weeks of each other only.

Table B.16: Summary of empirical evidence, hypothesis H6a, $\frac{\partial\psi(\mathrm{DRC}_1)}{\partial r} < 0$

Data type / Statistical test	Market adjusted returns All[1]		Market adjusted returns Two weeks[2]		Raw returns All[1]		Raw returns Two weeks[2]	
Comparison of quartiles								
All data								
t test	2.7:	.337	2.7:	.072				
W test	2.7:	.418	2.7:	.074				
Mean of each quarter's DRCs								
t test	B.38:	.221	B.38:	.109	B.69:	.096	B.69:	.061
W test	B.38:	.261	B.38:	.149	B.69:	.101	B.69:	.087
Median of each quarter's DRCs								
t test	B.38:	.384	B.38:	.122	B.69:	.127	B.69:	.053
W test	B.38:	.304	B.38:	.114	B.69:	.101	B.69:	.064
Regression results								
All data								
Univariate								
All data	2.8:	.226	2.8:	.014				
Positive DRCs only	2.8:	.001	2.8:	.014				
Log model	2.8:	.009	2.8:	.004				
Including tax rate T								
All data	2.8:	.342	2.8:	.326				
Positive DRCs only	2.8:	.244	2.8:	.270				
Log model	2.8:	.227	2.8:	.116				
Including quarter rates d, β, g								
All data	2.9:	.254	2.9:	.022				
Positive DRCs only	2.9:	.001	2.9:	.088				
Log model	2.9:	.026	2.9:	.053				
Including all rates T, d, β, g								
All data	2.9:	.363	2.9:	.326				
Positive DRCs only	2.9:	.376	2.9:	.363				
Log model	2.9:	.368	2.9:	.154				

Notes:
For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.17: Summary of empirical evidence, hypothesis H6a, $\frac{\partial\psi(\mathrm{DRC}_1)}{\partial r} < 0$ continued

Statistical test / Data type	Market adjusted returns: All[1]		Market adjusted returns: Two weeks[2]		Raw returns: All[1]		Raw returns: Two weeks[2]	
Regression results								
Mean of each quarter's DRCs								
Univariate								
All data	B.46:	.209	B.46:	.016	B.67:	.088	B.67:	.008
Positive DRCs only	B.46:	.099	B.46:	.023	B.67:	.059	B.67:	.027
Log model	B.46:	.091	B.46:	.052	B.67:	.052	B.67:	.052
Including tax rate T								
All data	B.47:	.250	B.47:	.330	B.71:	.378	B.71:	.654
Positive DRCs only	B.47:	.480	B.47:	.291	B.71:	.143	B.71:	.872
Log model	B.47:	.596	B.47:	.266	B.71:	.081	B.71:	.807
Median of each quarter's DRCs								
Univariate								
All data	B.46:	.216	B.46:	.011	B.67:	.052	B.67:	.003
Positive DRCs only	B.46:	.024	B.46:	.014	B.67:	.001	B.67:	.012
Log model	B.46:	.051	B.46:	.013	B.67:	.074	B.67:	.056
Including tax rate T								
All data	B.47:	.360	B.47:	.206	B.71:	.493	B.71:	.546
Positive DRCs only	B.47:	.316	B.47:	.372	B.71:	.309	B.71:	.869
Log model	B.47:	.290	B.47:	.274	B.71:	.876	B.71:	.880

Notes:

[1] Uses all the data.

[2] Uses observations with announcements within two weeks of each other only.

Table B.18: Summary of empirical evidence, hypothesis H6b, $\frac{\partial\psi(\mathrm{DRC}_2)}{\partial r} < 0$

Statistical test / Data type	Market adjusted returns: All[1]		Market adjusted returns: Two weeks[2]		Raw returns: All[1]		Raw returns: Two weeks[2]	
Comparison of quartiles								
All data								
t test	2.7:	.061	2.7:	.061				
W test	2.7:	.134	2.7:	.222				
Mean of each quarter's DRCs								
t test	B.38:	.084	B.38:	.073	B.69:	.020	B.69:	.017
W test	B.38:	.101	B.38:	.014	B.69:	.028	B.69:	.014
Median of each quarter's DRCs								
t test	B.38:	.197	B.38:	.266	B.69:	.140	B.69:	.154
W test	B.38:	.351	B.38:	.222	B.69:	.126	B.69:	.222
Regression results								
All data								
Univariate								
All data	2.10:	.027	2.10:	.089				
Positive DRCs only	2.10:	.000	2.10:	.000				
Log model	2.10:	.000	2.10:	.000				
Including tax rate T								
All data	2.10:	.454	2.10:	.670				
Positive DRCs only	2.10:	.409	2.10:	.534				
Log model	2.10:	.749	2.10:	.909				
Including quarter rates d, β, g								
All data	2.11:	.038	2.11:	.121				
Positive DRCs only	2.11:	.000	2.11:	.000				
Log model	2.11:	.000	2.11:	.000				
Including all rates T, d, β, g								
All data	2.11:	.516	2.11:	.711				
Positive DRCs only	2.11:	.516	2.11:	.546				
Log model	2.11:	.830	2.11:	.900				

Notes:
For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.19: Summary of empirical evidence, hypothesis H6b, $\frac{\partial\psi(\mathrm{DRC}_2)}{\partial r} < 0$ continued

Data type / Statistical test	Market adjusted returns: All[1]		Market adjusted returns: Two weeks[2]		Raw returns: All[1]		Raw returns: Two weeks[2]	
Regression results								
Mean of each quarter's DRCs								
Univariate								
All data	B.44:	.046	B.44:	.070	B.68:	.007	B.68:	.011
Positive DRCs only	B.44:	.007	B.44:	.019	B.68:	.003	B.68:	.001
Log model	B.44:	.042	B.44:	.053	B.68:	.009	B.68:	.016
Including tax rate T								
All data	B.45:	.510	B.45:	.618	B.72:	.426	B.72:	.578
Positive DRCs only	B.45:	.129	B.45:	.537	B.72:	.178	B.72:	.356
Log model	B.45:	.097	B.45:	.834	B.72:	.134	B.72:	.727
Median of each quarter's DRCs								
Univariate								
All data	B.44:	.120	B.44:	.252	B.68:	.137	B.68:	.158
Positive DRCs only	B.44:	.071	B.44:	.079	B.68:	.028	B.68:	.096
Log model	B.44:	.571	B.44:	.206	B.68:	.111	B.68:	.304
Including tax rate T								
All data	B.45:	.714	B.45:	.737	B.72:	.556	B.72:	.653
Positive DRCs only	B.45:	.519	B.45:	.549	B.72:	.218	B.72:	.670
Log model	B.45:	.252	B.45:	.932	B.72:	.118	B.72:	.931

Notes:

[1] Uses all the data.

[2] Uses observations with announcements within two weeks of each other only.

Table B.20: Summary of empirical evidence, hypothesis H6c, $\frac{\partial\psi(\mathrm{ERC}_1)}{\partial r} < 0$

Statistical test \ Data type	Market adjusted returns: All[1]		Market adjusted returns: Two weeks[2]		Raw returns: All[1]		Raw returns: Two weeks[2]	
Comparison of quartiles								
All data								
t test	2.7:	.569	2.7:	.524				
W test	2.7:	.948	2.7:	.997				
Mean of each quarter's DRCs								
t test	B.38:	.451	B.38:	.563	B.69:	.476	B.69:	.511
W test	B.38:	.500	B.38:	.649	B.69:	.399	B.69:	.551
Median of each quarter's DRCs								
t test	B.38:	.951	B.38:	.988	B.69:	.811	B.69:	.916
W test	B.38:	.920	B.38:	.980	B.69:	.649	B.69:	.958
Regression results								
All data								
Univariate								
All data	2.12:	.267	2.12:	.204				
Positive DRCs only	2.12:	.000	2.12:	.002				
Log model	2.12:	.009	2.12:	.143				
Including tax rate T								
All data	2.12:	.926	2.12:	.872				
Positive DRCs only	2.12:	.887	2.12:	.778				
Log model	2.12:	.984	2.12:	.971				
Including quarter rates d, β, g								
All data	2.13:	.268	2.13:	.202				
Positive DRCs only	2.13:	.001	2.13:	.003				
Log model	2.13:	.026	2.13:	.199				
Including all rates T, d, β, g								
All data	2.13:	.926	2.13:	.876				
Positive DRCs only	2.13:	.891	2.13:	.774				
Log model	2.13:	.987	2.13:	.961				

Notes:
For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.21: Summary of empirical evidence, hypothesis H6c, $\frac{\partial\psi(\mathrm{ERC}_1)}{\partial r} < 0$ continued

Data type / Statistical test	Market adjusted returns				Raw returns			
	All[1]		Two weeks[2]		All[1]		Two weeks[2]	
Regression results								
Mean of each quarter's ERCs								
Univariate								
All data	B.42:	.237	B.42:	.271	B.66:	.261	B.66:	.272
Positive ERCs only	B.42:	.096	B.42:	.220	B.66:	.081	B.66:	.166
Log model	B.42:	.262	B.42:	.482	B.66:	.009	B.66:	.207
Including tax rate T								
All data	B.43:	.832	B.43:	.803	B.70:	.886	B.70:	.861
Positive ERCs only	B.43:	.704	B.43:	.791	B.70:	.763	B.70:	.762
Log model	B.43:	.477	B.43:	.689	B.70:	.624	B.70:	.678
Median of each quarter's ERCs								
Univariate								
All data	B.42:	.960	B.42:	.982	B.66:	.809	B.66:	.843
Positive ERCs only	B.42:	.924	B.42:	.876	B.66:	.736	B.66:	.670
Log model	B.42:	.840	B.42:	.850	B.66:	.296	B.66:	.563
Including tax rate T								
All data	B.43:	.976	B.43:	.996	B.70:	.947	B.70:	.962
Positive ERCs only	B.43:	.963	B.43:	.968	B.70:	.958	B.70:	.758
Log model	B.43:	.556	B.43:	.972	B.70:	.754	B.70:	.548

Notes:
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.22: Summary of empirical evidence, hypothesis H7a, $\frac{\partial\psi(\mathrm{DRC}_1)}{\partial T} < 0$

Statistical test \ Data type	Market adjusted returns: All[1]		Market adjusted returns: Two weeks[2]		Raw returns: All[1]		Raw returns: Two weeks[2]	
Comparison of quartiles								
All data								
t test	2.7:	.207	2.7:	.038				
W test	2.7:	.269	2.7:	.034				
Mean of each quarter's DRCs								
t test	B.38:	.167	B.38:	.064	B.69:	.030	B.69:	.020
W test	B.38:	.216	B.38:	.047	B.69:	.026	B.69:	.021
Median of each quarter's DRCs								
t test	B.38:	.218	B.38:	.096	B.69:	.056	B.69:	.022
W test	B.38:	.064	B.38:	.059	B.69:	.052	B.69:	.021
Regression results								
All data								
Including interest rate r								
All data	2.8:	.474	2.8:	.244				
Positive DRCs only	2.8:	.122	2.8:	.294				
Log model	2.8:	.314	2.8:	.521				
Including all rates r, d, β, g								
All data	2.9:	.470	2.9:	.266				
Positive DRCs only	2.9:	.076	2.9:	.289				
Log model	2.9:	.230	2.9:	.527				
Mean of each quarter's DRCs								
Including interest rate r								
All data	B.47:	.566	B.47:	.334	B.71:	.267	B.71:	.068
Positive DRCs only	B.47:	.158	B.47:	.652	B.71:	.441	B.71:	.081
Log model	B.47:	.131	B.47:	.692	B.71:	.463	B.71:	.114
Median of each quarter's DRCs								
Including interest rate r								
All data	B.47:	.487	B.47:	.522	B.71:	.229	B.71:	.109
Positive DRCs only	B.47:	.317	B.47:	.379	B.71:	.156	B.71:	.093
Log model	B.47:	.211	B.47:	.394	B.71:	.036	B.71:	.067

Notes:
For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.
[1] Uses all the data.
[2] Uses observations with announcements within two weeks of each other only.

Table B.23: Summary of empirical evidence, hypothesis H7b, $\frac{\partial\psi(\mathrm{DRC}_2)}{\partial T} < 0$

Data type / Statistical test	Market adjusted returns All[1]		Two weeks[2]		Raw returns All[1]		Two weeks[2]	
Comparison of quartiles								
All data								
t test	2.7:	.041	2.7:	.104				
W test	2.7:	.064	2.7:	.204				
Mean of each quarter's DRCs								
t test	B.38:	.061	B.38:	.094	B.69:	.016	B.69:	.021
W test	B.38:	.064	B.38:	.020	B.69:	.016	B.69:	.007
Median of each quarter's DRCs								
t test	B.38:	.110	B.38:	.186	B.69:	.123	B.69:	.127
W test	B.38:	.186	B.38:	.088	B.69:	.094	B.69:	.136
Regression results								
All data								
Including interest rate r								
All data	2.10:	.246	2.10:	.177				
Positive DRCs only	2.10:	.041	2.10:	.053				
Log model	2.10:	.002	2.10:	.001				
Including all rates r, d, β, g								
All data	2.11:	.230	2.11:	.171				
Positive DRCs only	2.11:	.040	2.11:	.064				
Log model	2.11:	.002	2.11:	.001				
Mean of each quarter's DRCs								
Including interest rate r								
All data	B.45:	.234	B.45:	.192	B.72:	.193	B.72:	.121
Positive DRCs only	B.45:	.616	B.45:	.272	B.72:	.476	B.72:	.127
Log model	B.45:	.691	B.45:	.063	B.72:	.514	B.72:	.071
Median of each quarter's DRCs								
Including interest rate r								
All data	B.45:	.146	B.45:	.167	B.72:	.258	B.72:	.193
Positive DRCs only	B.45:	.296	B.45:	.289	B.72:	.571	B.72:	.257
Log model	B.45:	.769	B.45:	.032	B.72:	.682	B.72:	.069

Notes:

For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.

[1] Uses all the data.

[2] Uses observations with announcements within two weeks of each other only.

Table B.24: Summary of empirical evidence, hypothesis H7c, $\frac{\partial\psi(\mathrm{ERC}_1)}{\partial T} < 0$

Statistical test \ Data type	Market adjusted returns: All[1]		Market adjusted returns: Two weeks[2]		Raw returns: All[1]		Raw returns: Two weeks[2]	
Comparison of quartiles								
All data								
t test	2.7:	.154	2.7:	.153				
W test	2.7:	.807	2.7:	.920				
Mean of each quarter's ERCs								
t test	B.38:	.186	B.38:	.236	B.69:	.186	B.69:	.199
W test	B.38:	.318	B.38:	.604	B.69:	.247	B.69:	.437
Median of each quarter's ERCs								
t test	B.38:	.889	B.38:	.916	B.69:	.793	B.69:	.814
W test	B.38:	.753	B.38:	.886	B.69:	.682	B.69:	.679
Regression results								
All data								
Including interest rate r								
All data	2.12:	.040	2.12:	.070				
Positive ERCs only	2.12:	.004	2.12:	.027				
Log model	2.12:	.000	2.12:	.003				
Including all rates r, d, β, g								
All data	2.13:	.041	2.13:	.067				
Positive ERCs only	2.13:	.004	2.13:	.029				
Log model	2.13:	.000	2.13:	.006				
Mean of each quarter's ERCs								
Including interest rate r								
All data	B.43:	.105	B.43:	.140	B.70:	.071	B.70:	.090
Positive ERCs only	B.43:	.152	B.43:	.101	B.70:	.094	B.70:	.123
Log model	B.43:	.458	B.43:	.256	B.70:	.108	B.70:	.203
Median of each quarter's ERCs								
Including interest rate r								
All data	B.43:	.112	B.43:	.043	B.70:	.137	B.70:	.114
Positive ERCs only	B.43:	.118	B.43:	.077	B.70:	.082	B.70:	.321
Log model	B.43:	.571	B.43:	.044	B.70:	.147	B.70:	.522

Notes:

For each data type and statistical test, this table gives the table reference and the one tail probability of observing the data obtained, given the null hypothesis.

[1] Uses all the data.

[2] Uses observations with announcements within two weeks of each other only.

Table B.25: Descriptive statistics for firm rates and response coefficients

	Mean	St D	Prob0	Prob1	Q1	Q2	Q3	Prob2	Prob3	Obs
Payout rate	0.483	1.679			0.360	0.494	0.641			270
Beta	0.878	0.337			0.664	0.934	1.108			270
Growth rate	1.014	0.016			1.007	1.014	1.024			270
Mean ERC_0	1.384	7.556	.0029	.4048	-1.312	0.844	3.066	.0004	.5305	270
Median ERC_0	0.622	2.003	.0001	.0021	-0.032	0.248	0.736	.0001	.0001	270
Mean DRC_0	11.432	40.953	.0001	.0001	-3.376	6.540	25.754	.0001	.0001	266
Median DRC_0	8.763	33.624	.0001	.0002	-2.161	3.859	18.650	.0001	.0001	266
Mean ERC_1	1.907	11.479	.0195	.2641	-1.841	0.506	3.601	.0217	.6203	201
Median ERC_1	1.442	7.198	.0050	.3849	-0.141	0.273	1.226	.0001	.0001	201
Mean DRC_1	11.422	40.581	.0017	.0040	-2.519	5.564	22.894	.0001	.0001	130
Median DRC_1	11.584	41.606	.0019	.0044	-3.697	4.300	19.991	.0001	.0009	130
Mean ERC_2	-0.137	10.270	.8537	.1276	-1.683	0.363	1.986	.1901	.0119	191
Median ERC_2	0.088	5.546	.8272	.0241	-0.499	0.104	0.711	.1308	.0001	191
Mean DRC_2	8.228	52.864	.0522	.0877	-5.721	6.379	20.194	.0005	.0026	158
Median DRC_2	7.108	49.621	.0737	.1238	-5.290	3.461	18.818	.0006	.0059	158
When data restricted to announcements being within two weeks of each other										
Mean ERC_0	1.788	10.302	.0095	.2501	-1.397	0.829	3.940	.0004	.7535	227
Median ERC_0	0.873	4.199	.0020	.6501	-0.137	0.220	1.049	.0001	.0001	227
Mean DRC_0	12.192	52.330	.0012	.0030	-8.151	6.030	24.923	.0002	.0012	198
Median DRC_0	10.162	44.596	.0016	.0043	-5.737	4.363	21.780	.0001	.0007	198
Mean ERC_1	1.619	14.126	.1206	.5516	-2.422	0.487	3.586	.0867	.3979	185
Median ERC_1	1.221	8.698	.0578	.7303	-0.389	0.147	1.032	.0060	.0001	185
Mean DRC_1	10.172	29.878	.0107	.0207	-9.862	3.682	25.276	.0292	.0675	60
Median DRC_1	9.734	31.212	.0188	.0342	-8.824	3.463	20.047	.0511	.1159	60
Mean ERC_2	-0.447	14.706	.7282	.2620	-1.272	0.363	2.382	.2283	.0727	131
Median ERC_2	0.476	10.533	.6062	.5697	-0.962	0.191	1.358	.2265	.0003	131
Mean DRC_2	5.292	71.291	.4120	.5056	-10.063	4.883	19.176	.0564	.1266	123
Median DRC_2	5.388	70.164	.3961	.4893	-5.737	3.459	21.780	.0112	.0438	123

Notes:
Table provides the mean, the standard deviation, the (two tail) probability of observing the mean given the null hypothesis that the mean is zero (Prob0) or one (Prob1), the first, second, and third quartiles, the (two tail) probability of observing the median given the null hypothesis that the median is zero (Prob2) or one (Prob3), and the number of observations, and the reference for each response coefficient. ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends. Mean ERC and DRC are the means of the quarterly ERC and DRC for the firm; median ERC and DRC are the medians of the quarterly ERC and DRC for the firm.
Proxies:
Returns are two day returns over the announcement window less the market return.
Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.
Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.
The payout rate is calculated as the dividends paid out in 1980 to 1987 divided by net income for 1980 to 1987.
Beta is calculated by regressing 1980 to 1987 monthly returns on the CRSP equal weighted market returns.
The growth rate is calculated by regressing the logarithm of quarterly dividends for 1980 to 1987 on time.

Table B.26: Descriptive statistics for quarter rates and response coefficients

	Mean	St D	Prob0	Prob1	Q1	Q2	Q3	Prob2	Prob3	Obs
Interest rate	11.037	2.166			9.120	11.120	12.450			27
Mean ERC_0	1.327	2.487	.0101	.5002	-0.463	0.668	2.074	.0081	.8153	27
Median ERC_0	0.277	0.236	.0001	.0001	0.117	0.214	0.423	.0001	.0001	27
Mean DRC_0	12.258	13.596	.0001	.0002	1.280	11.796	16.013	.0001	.0001	27
Median DRC_0	5.319	5.724	.0001	.0006	1.482	5.506	7.614	.0001	.0002	27
Mean ERC_1	1.751	4.084	.0348	.3484	-0.721	1.322	2.673	.0317	.5740	27
Median ERC_1	0.320	0.386	.0002	.0001	0.127	0.218	0.373	.0001	.0001	27
Mean DRC_1	11.819	20.100	.0051	.0096	-6.380	9.962	18.809	.0048	.0096	27
Median DRC_1	5.986	10.051	.0047	.0160	1.482	6.363	9.973	.0016	.0048	27
Mean ERC_2	0.684	2.801	.2157	.5630	-1.149	0.484	2.306	.2564	.3972	27
Median ERC_2	0.244	0.277	.0001	.0001	0.051	0.204	0.373	.0001	.0001	27
Mean DRC_2	8.768	19.132	.0249	.0447	0.420	10.419	20.556	.0194	.0411	27
Median DRC_2	3.509	9.420	.0639	.1782	-1.302	3.063	8.109	.0667	.2178	27
When data restricted to announcements being within two weeks of each other										
Mean ERC_0	1.947	4.408	.0301	.2746	-0.954	1.096	3.108	.0276	.6398	27
Median ERC_0	0.297	0.374	.0003	.0001	0.033	0.128	0.440	.0001	.0001	27
Mean DRC_0	14.316	21.092	.0016	.0029	-0.702	11.671	18.862	.0010	.0027	27
Median DRC_0	7.438	9.502	.0004	.0016	1.860	6.652	11.452	.0001	.0003	27
Mean ERC_1	2.552	5.184	.0167	.1318	-0.564	2.170	4.676	.0057	.1677	27
Median ERC_1	0.361	0.451	.0003	.0001	-0.003	0.236	0.676	.0001	.0001	27
Mean DRC_1	16.757	30.864	.0121	.0175	-2.057	7.306	28.441	.0139	.0271	25
Median DRC_1	16.188	30.403	.0136	.0198	2.222	8.670	26.328	.0020	.0039	25
Mean ERC_2	1.034	6.647	.4264	.9793	-3.590	0.686	4.623	.6737	.6567	27
Median ERC_2	0.254	0.732	.0829	.0001	-0.016	0.118	0.279	.0317	.0001	27
Mean DRC_2	7.552	23.899	.1126	.1662	-2.416	2.869	23.089	.0790	.1263	27
Median DRC_2	4.671	12.269	.0586	.1321	-0.309	3.089	9.307	.0122	.0594	27

Notes:

Table provides the mean, the standard deviation, the (two tail) probability of observing the mean given the null hypothesis that the mean is zero (Prob0) or one (Prob1), the first, second, and third quartiles, the (two tail) probability of observing the median given the null hypothesis that the median is zero (Prob2) or one (Prob3), and the number of observations, and the reference for each response coefficient. ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends. Mean ERC and DRC are the means of the firm ERC and DRC for the quarter; median ERC and DRC are the medians of the firm ERC and DRC for the quarter.

Proxies:

Returns are two day returns over the announcement window less the market return.

Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.

Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

The interest rate is the yield on 10 year government bonds.

Table B.27: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients

Case & # of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept	Response coefficient	Adjusted R^2	White's χ^2
ERC_0				0	+		
	2.1, 2.2	2.1, 2.2		0.0013	0.041	.0039	.190
7287				.000	.000		
ERC_1				0	+		
	2.1	2.1		0.0009	0.041	.0019	.981
3403				.086	.003		
ERC_2				0	1		
	2.2	2.2		0.0003	0.054	.0089	.210
2489				.573	.000		
DRC_0				0	+		
	2.1, 2.2		2.1, 2.2	0.0019	1.793	.0050	.082
7287				.000	.000		
DRC_1				0	+		
	2.1		2.1	0.0010	1.466	.0054	.200
2489				.046	.000		
DRC_2				0	+		
	2.2		2.2	0.0021	2.186	.0049	.053
3403				.000	.000		

Notes:

First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the value of the one tail t test, i.e., the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. (The intercept tests are two tail).

ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.

Proxies:

Returns are two day returns over the announcement window less the market return.

Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.

Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.28: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when announcements are made within 2 weeks of each other

Case & # of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept	Response coefficient	Adjusted R^2	White's χ^2
ERC_0				0	+		
	2.1, 2.2	2.1, 2.2		0.0016	0.033	.0024	.421
4224				.002	.000		
ERC_1				0	+		
	2.1	2.1		0.0004	0.048	.0024	.488
2095				.608	.007		
ERC_2				0	1		
	2.2	2.2		0.0003	0.039	.0032	.503
734				.764	.034		
DRC_0				0	+		
	2.1, 2.2		2.1, 2.2	0.0023	2.269	.0062	.037
4224				.000	.000		
DRC_1				0	+		
	2.1		2.1	-0.0001	3.748	.0236	.206
734				.924	.000		
DRC_2				0	+		
	2.2		2.2	0.0027	1.563	.0018	.321
2095				.000	.014		

Notes:

First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the value of the one tail t test, i.e., the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. (The intercept tests are two tail).

ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.

Proxies:

Returns are two day returns over the announcement window less the market return.

Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.

Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.29: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when unexpected amounts less than .0001 set to zero

Case & # of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept	Response coefficient	Adjusted R^2	White's χ^2
ERC_0				0	+		
	2.1, 2.2	2.1, 2.2		0.0013	0.041	.0039	.190
7287				.000	.000		
ERC_1				0	+		
	2.1	2.1		0.0009	0.041	.0019	.981
3403				.086	.003		
ERC_2				0	1		
	2.2	2.2		0.0003	0.054	.0089	.210
2489				.573	.000		
DRC_0				0	+		
	2.1, 2.2		2.1, 2.2	0.0019	1.793	.0050	.082
7287				.000	.000		
DRC_1				0	+		
	2.1		2.1	0.0010	1.466	.0054	.200
2489				.046	.000		
DRC_2				0	+		
	2.2		2.2	0.0021	2.184	.0049	.054
3403				.000	.000		

Notes:

First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the value of the one tail t test, i.e., the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. (The intercept tests are two tail).

ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.

Proxies:

Returns are two day returns over the announcement window less the market return.

Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.

Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.30: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when announcements are made within 2 weeks of each other and when unexpected amounts less than .0001 set to zero

Case & # of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept	Response coefficient	Adjusted R^2	White's χ^2
ERC_0				0	+		
	2.1, 2.2	2.1, 2.2		0.0016	0.033	.0024	.421
4224				.002	.000		
ERC_1				0	+		
	2.1	2.1		0.0004	0.048	.0024	.488
2095				.608	.007		
ERC_2				0	1		
	2.2	2.2		0.0003	0.039	.0032	.502
734				.764	.034		
DRC_0				0	+		
	2.1, 2.2		2.1, 2.2	0.0023	2.267	.0061	.037
4224				.000	.000		
DRC_1				0	+		
	2.1		2.1	-0.0001	3.746	.0236	.206
734				.924	.000		
DRC_2				0	+		
	2.2		2.2	0.0027	1.557	.0018	.323
2095				.000	.014		

Notes:

First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the value of the one tail t test, i.e., the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. (The intercept tests are two tail). ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.

Proxies:

Returns are two day returns over the announcement window less the market return.

Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.

Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.31: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when unexpected amounts less than .0001 set to zero: average of 27 cross sectional regressions, up to 270 observations each

Case	Returns measured at	Earnings measured at	Dividends measured at	Intercept mean	Intercept median	Response coefficient mean	Response coefficient median
				0	0	+	+
ERC_0	2.1, 2.2	2.1, 2.2		0.0013	0.0014	0.079	0.043
				.052	.039	.000	.000
				0	0	+	+
ERC_1	2.1	2.1		0.0008	0.0003	0.124	0.059
				.304	.358	.004	.001
				0	0	1	1
ERC_2	2.2	2.2		0.0004	0.0010	0.138	0.086
				.553	.424	.000	.000
				0	0	+	+
DRC_0	2.1, 2.2		2.1, 2.2	0.0019	0.0014	4.548	4.292
				.000	.000	.000	.000
				0	0	+	+
DRC_1	2.1		2.1	0.0012	0.0011	2.171	1.597
				.035	.034	.064	.024
				0	0	+	+
DRC_2	2.2		2.2	0.0021	0.0018	4.978	2.566
				.001	.000	.000	.000

Notes:
First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. Tests of means are t tests: two tail tests for the intercepts, one tail tests for the response coefficients. Test of medians are nonparametric sign tests: two tail tests for the intercepts, one tail tests for the response coefficients.
ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.
Proxies:
Returns are two day returns over the announcement window less the market return.
Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.
Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.32: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when announcements are made within 2 weeks of each other and when unexpected amounts less than .0001 set to zero: average of 27 cross sectional regressions, up to 270 observations each

Case	Returns measured at	Earnings measured at	Dividends measured at	Intercept mean	Intercept median	Response coefficient mean	Response coefficient median
				0	0	+	+
ERC_0	2.1, 2.2	2.1, 2.2		0.0014	0.0014	0.069	0.036
				.034	.056	.003	.001
				0	0	+	+
ERC_1	2.2	2.1		0.0003	0.0004	0.148	0.083
				.647	.527	.002	.001
				0	0	1	1
ERC_2	2.2	2.2		0.0001	0.0008	0.124	0.039
				.931	.657	.013	.026
				0	0	+	+
DRC_0	2.1, 2.2		2.1, 2.2	0.0023	0.0021	7.012	4.756
				.000	.000	.000	.000
				0	0	+	+
DRC_1	2.1		2.1	0.0004	0.0016	9.602	2.286
				.660	.590	.006	.008
				0	0	+	+
DRC_2	2.2		2.2	0.0026	0.0028	6.066	2.818
				.001	.001	.004	.004

Notes:
First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. Tests of means are t tests: two tail tests for the intercepts, one tail tests for the response coefficients. Test of medians are nonparametric sign tests: two tail tests for the intercepts, one tail tests for the response coefficients.
ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.
Proxies:
Returns are two day returns over the announcement window less the market return.
Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.
Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.33: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when unexpected amounts less than .0001 set to zero: average of up to 270 times series regressions, up to 27 observations each

Case & # of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept mean	Intercept median	Response coefficient mean	Response coefficient median
ERC_0				0	0	+	+
	2.1, 2.2	2.1, 2.2		0.0013	0.0011	0.564	0.173
270				.001	.001	.000	.000
ERC_1				0	0	+	+
	2.1	2.1		0.0006	0.0013	0.890	0.218
201				.556	.309	.000	.000
ERC_2				0	0	1	1
	2.2	2.2		0.0006	0.0007	0.569	0.049
191				.542	.364	.002	.000
DRC_0				0	0	+	+
	2.1, 2.2		2.1, 2.2	0.0018	0.0019	6.669	5.276
270				.000	.000	.000	.000
DRC_1				0	0	+	+
	2.1		2.1	-0.0003	0.0003	8.231	0.000
191				.704	.637	.000	.000
DRC_2				0	0	+	+
	2.2		2.2	0.0026	0.0022	4.677	0.000
201				.019	.000	.064	.999

Notes:

First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. Tests of means are t tests: two tail tests for the intercepts, one tail tests for the response coefficients. Test of medians are nonparametric sign tests: two tail tests for the intercepts, one tail tests for the response coefficients.

ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.

Proxies:

Returns are two day returns over the announcement window less the market return.

Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.

Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.34: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when announcements are made within 2 weeks of each other and when unexpected amounts less than .0001 set to zero: average of up to 270 times series regressions, up to 27 observations each

Case & # of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept mean	Intercept median	Response coefficient mean	Response coefficient median
ERC_0				0	0	+	+
	2.1, 2.2	2.1, 2.2		0.0016	0.0010	0.524	0.153
227				.011	.012	.000	.000
ERC_1				0	0	+	+
	2.1	2.1		0.0004	0.0006	0.854	0.184
185				.659	.566	.000	.000
ERC_2				0	0	1	1
	2.2	2.2		0.0002	0.0013	0.928	0.036
131				.896	.402	.012	.000
DRC_0				0	0	+	+
	2.1, 2.2		2.1, 2.2	0.0024	0.0028	6.133	0.606
227				.000	.000	.009	.000
DRC_1				0	0	+	+
	2.1		2.1	-0.0004	0.0012	6.776	0.000
131				.824	.575	.007	.994
DRC_2				0	0	+	+
	2.2		2.2	0.0029	0.0022	4.928	0.000
185				.006	.000	.064	.992

Notes:

First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. Tests of means are t tests: two tail tests for the intercepts, one tail tests for the response coefficients. Test of medians are nonparametric sign tests: two tail tests for the intercepts, one tail tests for the response coefficients.

ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.

Proxies:

Returns are two day returns over the announcement window less the market return.

Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.

Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.35: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when unexpected amounts less than .0001 set to zero and the origin included in the data: average of up to 270 times series regressions, up to 28 observations each

Case & #.of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept mean	Intercept median	Response coefficient mean	Response coefficient median
ERC_0				0	0	+	+
	2.1, 2.2	2.1, 2.2		0.0012	0.0011	0.564	0.173
270				.001	.001	.000	.000
- ERC_1				0	0	+	+
	2.1	2.1		0.0008	0.0010	1.377	0.270
201				.184	.073	.002	.000
ERC_2				0	0	1	1
	2.2	2.2		0.0002	0.0000	0.792	0.166
191				.703	.524	.006	.000
DRC_0				0	0	+	+
	2.1, 2.2		2.1, 2.2	0.0018	0.0018	6.720	5.317
270				.000	.000	.000	.000
DRC_1				0	0	+	+
	2.1		2.1	0.0000	0.0001	6.903	0.000
191				.964	.477	.001	.000
DRC_2				0	0	+	+
	2.2		2.2	0.0021	0.0021	4.176	0.000
201				.002	.000	.078	.999

Notes:

First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. Tests of means are t tests: two tail tests for the intercepts, one tail tests for the response coefficients. Test of medians are nonparametric sign tests: two tail tests for the intercepts, one tail tests for the response coefficients.

ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.

Proxies:

Returns are two day returns over the announcement window less the market return.

Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.

Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.36: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when announcements are made within 2 weeks of each other, the origin is included in the data, and unexpected amounts less than .0001 are set to zero: average of up to 270 times series regressions, up to 28 observations each

Case & # of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept mean	Intercept median	Response coefficient mean	Response coefficient median
ERC_0				0	0	+	+
	2.1, 2.2	2.1, 2.2		0.0013	0.0007	0.628	0.161
227				.016	.017	.000	.000
ERC_1				0	0	+	+
	2.1	2.1		0.0004	0.0001	1.174	0.223
185				.566	.277	.024	.000
ERC_2				0	0	1	1
	2.2	2.2		-0.0002	0.0000	0.314	0.206
131				.828	.943	.340	.003
DRC_0				0	0	+	+
	2.1, 2.2		2.1, 2.2	0.0020	0.0026	6.272	0.511
227				.000	.000	.007	.000
DRC_1				0	0	+	+
	2.1		2.1	-0.0001	0.0006	6.122	0.000
131				.926	.549	.001	.002
DRC_2				0	0	+	+
	2.2		2.2	0.0021	0.0014	2.393	0.000
185				.002	.000	.273	.987

Notes:
First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. Tests of means are t tests: two tail tests for the intercepts, one tail tests for the response coefficients. Test of medians are nonparametric sign tests: two tail tests for the intercepts, one tail tests for the response coefficients.
ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.
Proxies:
Returns are two day returns over the announcement window less the market return.
Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.
Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.37: Evidence of variation in the response coefficients due to cross sectional variation in firm payout rates, firm betas, and firm dividend growth rates: probability (1 tail) of observing the difference in the mean (t test) or the mean rank (Wilcoxon test) of the response coefficients between the first and fourth quartiles of the rates, given the null hypotheses of no difference.

	All announcements				Announcements within 2 weeks of each other			
	Mean		Median		Mean		Median	
	t test	W test	t test	W test	t test	W test	t test	Wilcoxon test
Effect on the response coefficients of changes in the dividend payout rate								
ERC_0	.002	.011	.001	.002	.008	.030	.036	.128
ERC_1	.062	.113	.069	.009	.261	.114	.453	.096
ERC_2	.079	.234	.463	.721	.068	.417	.051	.493
DRC_0	.006	.007	.016	.113	.006	.016	.010	.084
DRC_1	.813	.607	.840	.734	.304	.536	.280	.550
DRC_2	.086	.013	.160	.138	.256	.097	.328	.151
Effect on the response coefficients of changes in the beta								
ERC_0	.543	.568	.412	.809	.580	.716	.153	.561
ERC_1	.174	.542	.103	.334	.263	.681	.091	.644
ERC_2	.391	.461	.727	.784	.457	.841	.963	.929
DRC_0	.899	.851	.783	.674	.570	.300	.559	.510
DRC_1	.566	.549	.277	.364	.164	.289	.251	.431
DRC_2	.876	.874	.804	.659	.451	.322	.414	.223
Effect on the response coefficients of changes in the dividend growth rate								
ERC_0	.000	.000	.004	.008	.000	.001	.006	.011
ERC_1	.047	.014	.052	.027	.064	.009	.112	.073
ERC_2	.027	.054	.586	.736	.016	.021	.108	.196
DRC_0	.001	.002	.008	.007	.000	.003	.001	.006
DRC_1	.325	.177	.453	.511	.403	.531	.364	.591
DRC_2	.064	.033	.064	.020	.014	.018	.008	.004

Notes:
Mean indicates the mean of each firm's response coefficients; median indicates the median of each firm's response coefficients.
ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.

Table B.38: Evidence of variation in the response coefficients due to time series variation in the risk free interest rate and the effective tax rate on dividends: probability (1 tail) of observing the difference in the mean (t test) or the mean rank (Wilcoxon test) of the response coefficients between the first and fourth quartiles of the rates, given the null hypotheses of no difference.

	All announcements				Announcements within 2 weeks of each other			
	Mean		Median		Mean		Median	
	t test	W test	t test	W test	t test	W test	t test	Wilcoxon test
Effect on the response coefficients of changes in the interest rate								
ERC_0	.192	.449	.911	.899	.366	.649	.852	.986
ERC_1	.451	.500	.951	.920	.563	.649	.988	.980
ERC_2	.061	.101	.290	.399	.454	.500	.582	.899
DRC_0	.033	.048	.257	.261	.024	.014	.213	.222
DRC_1	.221	.261	.384	.304	.109	.149	.122	.114
DRC_2	.084	.101	.197	.351	.073	.014	.266	.222
Effect on the response coefficients of changes in the effective tax rate on dividends								
ERC_0	.084	.247	.831	.753	.181	.521	.778	.991
ERC_1	.186	.318	.889	.753	.236	.604	.916	.886
ERC_2	.079	.186	.070	.114	.188	.247	.321	.753
DRC_0	.010	.026	.071	.094	.013	.007	.070	.094
DRC_1	.167	.216	.218	.064	.064	.047	.096	.059
DRC_2	.061	.064	.110	.186	.094	.020	.186	.088

Notes:

Mean indicates the mean of each quarter's response coefficients; median indicates the median of each quarter's response coefficients.

ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.

Table B.39: Evidence on the cross-sectional variation in earnings response coefficients, when earnings announced first

$$\text{Response coefficient} = b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} + b_3 * \text{Dividend growth rate}$$

Obs	Case	b_0	b_1	b_2	b_3	Adjusted	White's	Largest
	Predicted		–	–	+	R^2	χ^2	VIF
All	Mean ERC_1	-47.332	-0.002	-2.742	51.060	.0000	.4346	1.024
201		.367	.499	.148	.161			
All	Median ERC_1	-36.423	-0.037	-3.502	40.556	.0178	.8895	1.024
201		.264	.453	.016	.103			
Pos	Mean ERC_1	-113.667	-0.697	-3.163	121.934	.0098	.9027	1.210
116		.154	.441	.206	.057			
Pos	Median ERC_1	-73.867	0.280	-5.226	80.263	.0423	.9509	1.174
132		.168	.534	.016	.061			
Log	Mean ERC_1	0.428	0.694	0.310	23.200	.0313	.3527	1.060
116		.176	.884	.831	.009			
Log	Median ERC_1	-0.757	0.119	0.184	33.154	.0707	.4884	1.060
132		.013	.582	.726	.000			
When data restricted to announcements being within two weeks of each other								
All	Mean ERC_1	-78.928	0.126	-1.292	80.573	.0000	.2924	1.026
185		.260	.580	.350	.121			
All	Median ERC_1	-47.288	0.081	-3.537	51.070	.0099	.6389	1.026
185		.269	.584	.043	.112			
Pos	Mean ERC_1	-137.288	0.194	-3.418	146.232	.0071	.7807	1.210
101		.141	.514	.227	.053			
Pos	Median ERC_1	-168.144	1.078	-7.418	175.854	.0836	.9308	1.196
108		.027	.606	.008	.009			
Log	Mean ERC_1	0.879	0.352	0.113	12.314	.0000	.6210	1.051
101		.004	.743	.627	.103			
Log	Median ERC_1	-0.774	0.243	-0.017	41.659	.0771	.5194	1.051
108		.030	.653	.482	.000			

Notes:

Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent varaiables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each firms' earnings response coefficients was the dependent variable; median indicates that the median of each firms' earnings response coefficients was the dependent variable.

The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table B.40: Evidence on the cross-sectional variation in dividend response coefficients, when dividends announced second

$$\text{Response coefficient} = b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} + b_3 * \text{Dividend growth rate}$$

Obs	Case	b_0	b_1	b_2	b_3	Adjusted R^2	White's χ^2	Largest VIF
	Predicted		−	−	+			
All	Mean DRC_2	-269.463	-15.210	1.048	280.028	.0000	.3963	1.459
158		.408	.269	.526	.184			
All	Median DRC_2	-186.817	-12.250	-2.502	199.296	.0000	.3250	1.459
158		.542	.299	.433	.249			
Pos	Mean DRC_2	-685.354	-33.160	-8.479	727.907	.0716	.6359	1.643
100		.061	.098	.282	.019			
Pos	Median DRC_2	-466.790	-26.742	-10.637	509.094	.0452	.5331	1.603
99		.134	.134	.237	.043			
Log	Mean DRC_2	3.496	-2.889	-0.157	17.006	.1007	.8561	1.637
100		.000	.012	.312	.067			
Log	Median DRC_2	2.593	-1.390	-0.099	25.300	.0841	.9702	1.618
99		.000	.141	.396	.008			
When data restricted to announcements being within two weeks of each other								
All	Mean DRC_2	-725.690	-17.586	-25.921	752.218	.0144	.6443	1.494
123		.156	.317	.142	.063			
All	Median DRC_2	-788.857	-8.246	-25.696	809.748	.0161	.6469	1.494
123		.117	.410	.140	.047			
Pos	Mean DRC_2	-1056.861	-51.763	-27.918	1122.392	.0970	.2224	1.704
73		.038	.103	.104	.011			
Pos	Median DRC_2	-1168.510	-28.444	-20.346	1212.044	.0818	.2833	1.734
74		.024	.228	.169	.008			
Log	Mean DRC_2	3.648	-4.061	-0.861	24.694	.1363	.5210	1.663
73		.000	.010	.019	.037			
Log	Median DRC_2	2.718	-1.332	-0.294	25.198	.0472	.3826	1.672
74		.000	.187	.213	.029			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent varaiables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each firms' dividend response coefficients was the dependent variable; median indicates that the median of each firms' dividend response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table B.41: Evidence on the cross-sectional variation in dividend response coefficients, when dividends announced first

$$\text{Response coefficient} = b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} + b_3 * \text{Dividend growth rate}$$

Obs	Case	b_0	b_1	b_2	b_3	Adjusted	White's	Largest
	Predicted		–	–	+	R^2	χ^2	VIF
All	Mean DRC_1	-139.390	-1.442	-5.506	153.384	.0000	.6257	1.057
130		.539	.213	.312	.246			
All	Median DRC_1	-60.408	-1.520	-8.814	78.380	.0000	.5761	1.057
130		.794	.207	.223	.366			
Pos	Mean DRC_1	-245.703	-8.611	-6.950	277.662	.0000	.8750	2.054
87		.439	.327	.306	.179			
Pos	Median DRC_1	-365.060	-8.194	-0.553	391.760	.0095	.7577	1.730
81		.256	.342	.486	.100			
Log	Mean DRC_1	2.604	-0.838	-0.157	15.946	.0306	.7448	2.077
87		.000	.264	.324	.094			
Log	Median DRC_1	2.686	-0.832	0.156	13.731	.0136	.8192	1.737
81		.000	.287	.654	.126			
When data restricted to announcements being within two weeks of each other								
All	Mean DRC_1	-117.019	-1.587	-5.259	129.897	.0000	.3471	1.081
60		.573	.126	.327	.262			
All	Median DRC_1	-134.748	-1.556	-2.521	144.731	.0000	.4674	1.081
60		.536	.141	.419	.249			
Pos	Mean DRC_1	-148.651	-37.987	-24.593	211.587	.0758	.6714	1.269
36		.561	.052	.050	.196			
Pos	Median DRC_1	-86.959	-41.311	-14.941	145.147	.0757	.8218	1.450
36		.744	.051	.186	.282			
Log	Mean DRC_1	3.394	-2.114	-0.362	1.543	.0000	.5538	1.332
36		.000	.148	.258	.456			
Log	Median DRC_1	3.816	-3.516	-0.264	9.418	.1200	.5830	1.507
36		.000	.034	.313	.211			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent varaiables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each firms' dividend response coefficients was the dependent variable; median indicates that the median of each firms' dividend response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table B.42: Evidence on the time series variation in earnings response coefficients, when earnings announced first

Response coefficient $= b_0 + b_1 *$ Interest rate

Obs	Case Predicted	b_0	b_1 –	Adjusted R^2	White's χ^2
All	Mean ERC_1	4.743	-0.271	.0000	.1844
27		.269	.237		
All	Median ERC_1	-0.352	0.061	.0819	.4779
27		.358	.960		
Pos	Mean ERC_1	9.184	-0.524	.0456	.3602
19		.050	.096		
Pos	Median ERC_1	-0.206	0.051	.0476	.2808
25		.603	.924		
Log	Mean ERC_1	2.560	-0.754	.0000	.1227
19		.369	.262		
Log	Median ERC_1	-4.269	1.167	.0015	.8408
25		.134	.840		
When data restricted to announcements being within two weeks of each other					
All	Mean ERC_1	5.793	-0.294	.0000	.2509
27		.288	.271		
All	Median ERC_1	-0.569	0.084	.1308	.9966
27		.195	.982		
Pos	Mean ERC_1	10.169	-0.516	.0000	.3480
18		.180	.220		
Pos	Median ERC_1	-0.116	0.056	.0215	.8150
20		.833	.876		
Log	Mean ERC_1	1.187	-0.066	.0000	.1683
18		.737	.482		
Log	Median ERC_1	-3.976	1.232	.0073	.2794
20		.173	.850		

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each quarter's earnings response coefficients was the dependent variable; median indicates that the median of each quarter's earnings response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table B.43: Evidence on the time series variation in earnings response coefficients, when earnings announced first

Response coefficient $=$ $b_0 + b_1 *$ Interest rate $+ b_2 *$ Tax rate dummy

Obs	Case	b_0	b_1	b_2	Adjusted	White's	Largest
	Predicted		$-$	$+$	R^2	χ^2	VIF
All	Mean ERC_1	-130.931	1.067	1.439	.0000	.5434	4.899
16		.224	.832	.105			
All	Median ERC_1	-9.133	0.153	0.092	.2446	.5606	4.899
16		.200	.976	.112			
Pos	Mean ERC_1	-113.963	0.650	1.309	.0129	.6779	5.269
12		.339	.704	.152			
Pos	Median ERC_1	-8.691	0.139	0.089	.1725	.3603	4.578
15		.218	.963	.118			
Log	Mean ERC_1	-1.940	-0.226	0.038	.0000	.2826	5.928
12		.960	.477	.458			
Log	Median ERC_1	1.961	0.490	-0.058	.0000	.4003	5.324
15		.954	.556	.571			
When data restricted to announcements being within two weeks of each other							
All	Mean ERC_1	-145.636	1.229	1.603	.0000	.7680	4.899
16		.296	.803	.140			
All	Median ERC_1	-13.580	0.217	0.137	.4112	.6150	4.899
16		.071	.996	.043			
Pos	Mean ERC_1	-196.984	1.482	2.206	.0371	.7221	3.839
11		.226	.791	.101			
Pos	Median ERC_1	-12.096	0.170	0.127	.2212	.4105	3.494
11		.147	.968	.077			
Log	Mean ERC_1	-25.307	2.188	0.249	.0000	.5650	4.291
11		.541	.689	.256			
Log	Median ERC_1	-40.878	4.414	0.349	.2297	.3026	4.022
11		.068	.972	.044			

Notes:
Obs gives number of quarter's used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each quarter's earnings response coefficients was the dependent variable; median indicates that the median of each quarter's earnings response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)
The tax rate dummy is 0 for quarters 1981:2 to 1983:1 and 1 for quarters 1986:1 to 1987:4. Quarters 1983:2 to 1985:4 were excluded from the data.

Table B.44: Evidence on the time series variation in dividend response coefficients, when dividends announced second

Response coefficient $= b_0 + b_1 *$ Interest rate

Obs	Case Predicted	b_0	b_1 –	Adjusted R^2	White's χ^2
All	Mean DRC_2	41.173	-2.936	.0749	.1978
27		.037	.046		
All	Median DRC_2	14.756	-1.019	.0171	.3206
27		.133	.120		
Pos	Mean DRC_2	51.699	-3.228	.2361	.0379
21		.001	.007		
Pos	Median DRC_2	20.414	-1.202	.0661	.3164
20		.031	.071		
Log	Mean DRC_2	7.590	-2.203	.1040	.5378
21		.016	.042		
Log	Median DRC_2	0.258	0.416	.0000	.3381
20		.963	.571		
When data restricted to announcements being within two weeks of each other					
All	Mean DRC_2	43.137	-3.224	.0488	.2897
27		.081	.070		
All	Median DRC_2	13.070	-0.761	.0000	.2819
27		.310	.252		
Pos	Mean DRC_2	66.469	-4.300	.2228	.2684
16		.006	.019		
Pos	Median DRC_2	26.828	-1.614	.0621	.4055
19		.040	.079		
Log	Mean DRC_2	7.797	-2.236	.1174	.2947
16		.022	.053		
Log	Median DRC_2	4.536	-1.213	.0000	.3836
19		.201	.206		

Notes:
Obs gives number of quarter's used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each quarter's dividend response coefficients was the dependent variable; median indicates that the median of each quarter's dividend response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table B.45: Evidence on the time series variation in dividend response coefficients, when dividends announced second

Response coefficient $= b_0 + b_1 * \text{Interest rate} + b_2 * \text{Tax rate dummy}$

Obs	Case Predicted	b_0	b_1 $-$	b_2 $+$	Adjusted R^2	White's χ^2	Largest VIF
All	Mean DRC_2	-258.052	0.107	3.188	.0360	.2588	4.899
16		.532	.510	.234			
All	Median DRC_2	-215.137	1.264	2.452	.0000	.5554	4.899
16		.323	.714	.146			
Pos	Mean DRC_2	163.214	-4.612	-1.128	.2318	.1066	6.528
13		.654	.129	.616			
Pos	Median DRC_2	-119.978	0.136	1.494	.0000	.2117	6.528
13		.650	.519	.296			
Log	Mean DRC_2	23.598	-4.076	-0.137	.2549	.3560	6.961
13		.434	.097	.691			
Log	Median DRC_2	64.350	-5.876	-0.586	.0000	.7191	6.961
13		.459	.252	.769			
When data restricted to announcements being within two weeks of each other							
All	Mean DRC_2	-431.893	1.688	5.057	.0015	.4558	4.899
16		.427	.618	.192			
All	Median DRC_2	-301.836	2.148	3.366	.0000	.6318	4.899
16		.356	.737	.167			
Pos	Mean DRC_2	-481.532	0.836	5.878	.2737	.3135	18.267
10		.599	.537	.272			
Pos	Median DRC_2	-202.304	0.532	2.434	.0000	.7742	7.296
12		.626	.549	.289			
Log	Mean DRC_2	-57.882	3.718	0.616	.4861	.5467	18.066
10		.174	.834	.063			
Log	Median DRC_2	-84.947	6.909	0.831	.2278	.3279	7.488
12		.077	.932	.032			

Notes:
Obs gives number of quarter's used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each quarter's dividend response coefficients was the dependent variable; median indicates that the median of each quarter's dividend response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)
The tax rate dummy is 0 for quarters 1981:2 to 1983:1 and 1 for quarters 1986:1 to 1987:4. Quarters 1983:2 to 1985:4 were excluded from the data.

Table B.46: Evidence on the time series variation in dividend response coefficients, when dividends announced first

Response coefficient $= b_0 + b_1 * \text{Interest rate}$

Obs	Case Predicted	b_0	b_1 –	Adjusted R^2	White's χ^2
All	Mean DRC_1	28.490	-1.511	.0000	.2408
27		.179	.209		
All	Median DRC_1	14.067	-0.732	.0000	.1891
27		.184	.216		
Pos	Mean DRC_1	45.941	-2.364	.0400	.3659
20		.032	.099		
Pos	Median DRC_1	26.440	-1.564	.1383	.3585
22		.006	.024		
Log	Mean DRC_1	5.813	-1.319	.0467	.1628
20		.020	.091		
Log	Median DRC_1	5.482	-1.508	.0841	.4850
22		.017	.051		
When data restricted to announcements being within two weeks of each other					
All	Mean DRC_1	86.210	-6.248	.1491	.1871
25		.011	.016		
All	Median DRC_1	88.892	-6.540	.1740	.2242
25		.007	.011		
Pos	Mean DRC_1	120.578	-8.426	.2021	.3766
16		.012	.023		
Pos	Median DRC_1	100.100	-7.176	.1887	.3280
21		.007	.014		
Log	Mean DRC_1	11.520	-3.716	.1183	.5466
16		.039	.052		
Log	Median DRC_1	10.714	-3.544	.1929	.8489
21		.006	.013		

Notes:
Obs gives number of quarter's used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each quarter's dividend response coefficients was the dependent variable; median indicates that the median of each quarter's dividend response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table B.47: Evidence on the time series variation in dividend response coefficients, when dividends announced first

Response coefficient $= b_0 + b_1 *$ Interest rate $+ b_2 *$ Tax rate dummy

Obs	Case Predicted	b_0	b_1 −	b_2 +	Adjusted R^2	White's χ^2	Largest VIF
All	Mean DRC_1	103.532	-2.986	-0.750	.0000	.3123	4.899
16		.806	.250	.566			
All	Median DRC_1	8.508	-0.939	0.084	.0000	.5466	4.899
16		.973	.360	.487			
Pos	Mean DRC_1	-250.997	-0.152	3.231	.2665	.2463	4.143
10		.398	.480	.158			
Pos	Median DRC_1	-65.722	-0.973	1.014	.1379	.7794	4.112
12		.740	.316	.317			
Log	Mean DRC_1	-16.376	0.454	0.214	.2555	.3282	5.089
10		.411	.596	.131			
Log	Median DRC_1	-6.318	-0.866	0.122	.3820	.2027	4.658
12		.693	.290	.211			
When data restricted to announcements being within two weeks of each other							
All	Mean DRC_1	-229.507	-3.382	3.307	.0917	.5809	4.578
15		.752	.330	.334			
All	Median DRC_1	124.704	-6.459	-0.438	.0616	.6135	4.578
15		.865	.206	.522			
Pos	Mean DRC_1	1322.869	-18.528	-12.846	.0000	.3860	8.401
6		.673	.291	.652			
Pos	Median DRC_1	-172.526	-3.173	2.768	.0000	.7084	4.206
11		.838	.372	.379			
Log	Mean DRC_1	41.480	-4.337	-0.330	.0000	.5333	5.872
6		.561	.266	.692			
Log	Median DRC_1	0.056	-2.602	0.101	.1408	.5096	4.666
11		.999	.274	.394			

Notes:
Obs gives number of quarter's used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each quarter's dividend response coefficients was the dependent variable; median indicates that the median of each quarter's dividend response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)
The tax rate dummy is 0 for quarters 1981:2 to 1983:1 and 1 for quarters 1986:1 to 1987:4. Quarters 1983:2 to 1985:4 were excluded from the data.

Table B.48: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients

Case & # of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept	Response coefficient	Adjusted R^2	White's χ^2
ERC_0				0	+		
	2.1, 2.2	2.1, 2.2		0.0012	0.034	.0019	.220
7287				.007	.000		
ERC_1				0	+		
	2.1	2.1		0.0002	0.029	.0005	.929
3403				.789	.053		
ERC_2				0	1		
	2.2	2.2		0.0008	0.050	.0056	.272
2489				.245	.000		
DRC_0				0	+		
	2.1, 2.2		2.1, 2.2	0.0034	1.809	.0041	.050
7287				.000	.000		
DRC_1				0	+		
	2.1		2.1	0.0024	1.594	.0054	.118
2489				.000	.000		
DRC_2				0	+		
	2.2		2.2	0.0038	2.087	.0034	.140
3403				.000	.000		

Notes:
First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the value of the one tail t test, i.e., the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. (The intercept tests are two tail).
ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.
Proxies:
Returns are two day returns over the announcement window.
Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.
Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.49: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when announcements are made within 2 weeks of each other

Case & # of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept	Response coefficient	Adjusted R^2	White's χ^2
ERC_0				0	+		
	2.1, 2.2	2.1, 2.2		0.0014	0.023	.0007	.200
4224				.020	.025		
ERC_1				0	+		
	2.1	2.1		-0.0007	0.030	.0002	.136
2095				.456	.115		
ERC_2				0	1		
	2.2	2.2		0.0017	0.032	.0009	.300
734				.210	.101		
DRC_0				0	+		
	2.1, 2.2		2.1, 2.2	0.0035	2.092	.0039	.070
4224				.000	.000		
DRC_1				0	+		
	2.1		2.1	0.0008	3.443	.0152	.217
734				.519	.000		
DRC_2				0	+		
	2.2		2.2	0.0041	1.325	.0007	.501
2095				.000	.059		

Notes:
First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the value of the one tail t test, i.e., the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. (The intercept tests are two tail).
ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.
Proxies:
Returns are two day returns over the announcement window.
Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.
Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.50: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when unexpected amounts less than .0001 set to zero

Case & # of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept	Response coefficient	Adjusted R^2	White's χ^2
ERC_0				0	+		
	2.1, 2.2	2.1, 2.2		0.0012	0.034	.0019	.220
7287				.007	.000		
ERC_1				0	+		
	2.1	2.1		0.0002	0.029	.0005	.929
3403				.789	.053		
ERC_2				0	1		
	2.2	2.2		0.0008	0.050	.0056	.272
2489				.245	.000		
DRC_0				0	+		
	2.1, 2.2		2.1, 2.2	0.0034	1.808	.0041	.050
7287				.000	.000		
DRC_1				0	+		
	2.1		2.1	0.0024	1.595	.0054	.118
2489				.000	.000		
DRC_2				0	+		
	2.2		2.2	0.0038	2.084	.0034	.140
3403				.000	.000		

Notes:
First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the value of the one tail t test, i.e., the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. (The intercept tests are two tail).
ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.
Proxies:
Returns are two day returns over the announcement window.
Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.
Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.51: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when announcements are made within 2 weeks of each other and when unexpected amounts less than .0001 set to zero

Case & # of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept	Response coefficient	Adjusted R^2	White's χ^2
ERC_0				0	+		
	2.1, 2.2	2.1, 2.2		0.0014	0.023	.0007	.200
4224				.020	.025		
ERC_1				0	+		
	2.1	2.1		-0.0007	0.030	.0002	.136
2095				.456	.115		
ERC_2				0	1		
	2.2	2.2		0.0017	0.032	.0009	.300
734				.210	.101		
DRC_0				0	+		
	2.1, 2.2		2.1, 2.2	0.0035	2.089	.0039	.070
4224				.000	.000		
DRC_1				0	+		
	2.1		2.1	0.0008	3.441	.0152	.217
734				.519	.000		
DRC_2				0	+		
	2.2		2.2	0.0041	1.318	.0007	.501
2095				.000	.060		

Notes:
First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the value of the one tail t test, i.e., the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. (The intercept tests are two tail).
ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.
Proxies:
Returns are two day returns over the announcement window.
Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.
Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.52: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when unexpected amounts less than .0001 set to zero: average of 27 cross sectional regressions, up to 270 observations each

Case	Returns measured at	Earnings measured at	Dividends measured at	Intercept mean	Intercept median	Response coefficient mean	Response coefficient median
				0	0	+	+
ERC_0	2.1, 2.2	2.1, 2.2		0.0011	0.0029	0.076	0.029
				.454	.019	.002	.000
				0	0	+	+
ERC_1	2.1	2.1		0.0004	0.0010	0.112	0.067
				.812	.176	.008	.002
				0	0	1	1
ERC_2	2.2	2.2		0.0006	0.0028	0.129	0.069
				.748	.041	.000	.000
				0	0	+	+
DRC_0	2.1, 2.2		2.1, 2.2	0.0033	0.0036	5.436	4.433
				.000	.000	.000	.000
				0	0	+	+
DRC_1	2.1		2.1	0.0025	0.0016	3.459	1.928
				.002	.001	.006	.003
				0	0	+	+
DRC_2	2.2		2.2	0.0039	0.0042	5.224	3.084
				.000	.000	.002	.001

Notes:
First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. Tests of means are t tests: two tail tests for the intercepts, one tail tests for the response coefficients. Test of medians are nonparametric sign tests: two tail tests for the intercepts, one tail tests for the response coefficients.
ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.
Proxies:
Returns are two day returns over the announcement window.
Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.
Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.53: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when announcements are made within 2 weeks of each other and when unexpected amounts less than .0001 set to zero: average of 27 cross sectional regressions, up to 270 observations each

Case	Returns measured at	Earnings measured at	Dividends measured at	Intercept mean	Intercept median	Response coefficient mean	Response coefficient median
				0	0	+	+
ERC_0	2.1, 2.2	2.1, 2.2		0.0013	0.0024	0.061	0.022
				.400	.026	.013	.004
				0	0	+	+
ERC_1	2.2	2.1		-0.0003	0.0010	0.120	0.078
				.866	.384	.005	.004
				0	0	1	1
ERC_2	2.2	2.2		0.0013	0.0024	0.090	0.029
				.520	.146	.043	.084
				0	0	+	+
DRC_0	2.1, 2.2		2.1, 2.2	0.0036	0.0042	7.446	4.772
				.002	.001	.000	.000
				0	0	+	+
DRC_1	2.1		2.1	0.0009	0.0008	10.179	1.352
				.550	.277	.011	.017
				0	0	+	+
DRC_2	2.2		2.2	0.0042	0.0047	6.177	0.986
				.001	.000	.010	.014

Notes:
First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. Tests of means are t tests: two tail tests for the intercepts, one tail tests for the response coefficients. Test of medians are nonparametric sign tests: two tail tests for the intercepts, one tail tests for the response coefficients.
ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.
Proxies:
Returns are two day returns over the announcement window.
Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.
Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.54: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when unexpected amounts less than .0001 set to zero: average of up to 270 times series regressions, up to 27 observations each

Case & # of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept mean	Intercept median	Response coefficient mean	Response coefficient median
ERC_0				0	0	+	+
	2.1, 2.2	2.1, 2.2		0.0011	0.0018	0.514	0.129
270				.014	.003	.000	.000
ERC_1				0	0	+	+
	2.1	2.1		-0.0007	0.0000	0.603	0.168
201				.475		.037	.000
ERC_2				0	0	1	1
	2.2	2.2		0.0012	0.0017	0.689	0.049
191				.270	.138	.003	.000
DRC_0				0	0	+	+
	2.1, 2.2		2.1, 2.2	0.0033	0.0038	6.802	4.715
270				.000	.000	.000	.000
DRC_1				0	0	+	+
	2.1		2.1	0.0019	0.0024	7.686	0.000
191				.043	.001	.000	
DRC_2				0	0	+	+
	2.2		2.2	0.0041	0.0037	5.216	0.000
201				.000	.000	.060	

Notes:

First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. Tests of means are t tests: two tail tests for the intercepts, one tail tests for the response coefficients. Test of medians are nonparametric sign tests: two tail tests for the intercepts, one tail tests for the response coefficients.

ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.

Proxies:

Returns are two day returns over the announcement window.

Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.

Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.55: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when announcements are made within 2 weeks of each other and when unexpected amounts less than .0001 set to zero: average of up to 270 times series regressions, up to 27 observations each

Case & # of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept mean	Intercept median	Response coefficient mean	Response coefficient median
ERC_0				0	0	+	+
	2.1, 2.2	2.1, 2.2		0.0013	0.0018	0.387	0.064
227				.046	.036	.013	.000
ERC_1				0	0	+	+
	2.1	2.1		-0.0008	-0.0002	0.440	0.132
185				.496	.560	.137	.000
ERC_2				0	0	1	1
	2.2	2.2		0.0010	0.0026	1.553	0.010
131				.563	.096	.044	.000
DRC_0				0	0	+	+
	2.1, 2.2		2.1, 2.2	0.0032	0.0043	6.388	1.346
227				.000	.000	.017	.003
DRC_1				0	0	+	+
	2.1		2.1	0.0007	0.0031	7.367	0.000
131				.829	.024	.071	
DRC_2				0	0	+	+
	2.2		2.2	0.0038	0.0044	6.146	0.000
185				.003	.000	.041	

Notes:

First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. Tests of means are t tests: two tail tests for the intercepts, one tail tests for the response coefficients. Test of medians are nonparametric sign tests: two tail tests for the intercepts, one tail tests for the response coefficients.

ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.

Proxies:

Returns are two day returns over the announcement window.

Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.

Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.56: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when unexpected amounts less than .0001 set to zero and the origin included in the data: average of up to 270 times series regressions, up to 28 observations each

Case & # of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept mean	Intercept median	Response coefficient mean	Response coefficient median
ERC_0				0	0	+	+
	2.1, 2.2	2.1, 2.2		0.0010	0.0018	0.514	0.127
270				.014	.003	.000	.000
ERC_1				0	0	+	+
	2.1	2.1		-0.0003	0.0000	1.236	0.197
201				.642		.020	.000
ERC_2				0	0	1	1
	2.2	2.2		0.0006	0.0000	0.769	0.124
191				.262		.013	.000
DRC_0				0	0	+	+
	2.1, 2.2		2.1, 2.2	0.0031	0.0036	6.866	4.743
270				.000	.000	.000	.000
DRC_1				0	0	+	+
	2.1		2.1	0.0016	0.0022	6.897	0.000
191				.013	.000	.002	
DRC_2				0	0	+	+
	2.2		2.2	0.0034	0.0034	4.863	0.000
201				.000	.000	.068	

Notes:

First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. Tests of means are t tests: two tail tests for the intercepts, one tail tests for the response coefficients. Test of medians are nonparametric sign tests: two tail tests for the intercepts, one tail tests for the response coefficients.

ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.

Proxies:

Returns are two day returns over the announcement window.

Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.

Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.57: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, when announcements are made within 2 weeks of each other, the origin is included in the data, and unexpected amounts less than .0001 are set to zero: average of up to 270 times series regressions, up to 28 observations each

Case & # of observations	Returns measured at	Earnings measured at	Dividends measured at	Intercept mean	Intercept median	Response coefficient mean	Response coefficient median
ERC_0				0	0	+	+
	2.1, 2.2	2.1, 2.2		0.0011	0.0016	0.505	0.081
227				.074	.021	.004	.000
ERC_1				0	0	+	+
	2.1	2.1		-0.0009	0.0000	0.559	0.191
185				.263		.269	.000
ERC_2				0	0	1	1
	2.2	2.2		0.0003	0.0000	1.331	0.162
131				.780		.077	.014
DRC_0				0	0	+	+
	2.1, 2.2		2.1, 2.2	0.0029	0.0040	6.404	1.146
227				.000	.000	.014	.002
DRC_1				0	0	+	+
	2.1		2.1	0.0007	0.0020	5.418	0.000
131				.706	.030	.039	
DRC_2				0	0	+	+
	2.2		2.2	0.0028	0.0038	3.502	0.000
185				.002	.000	.205	

Notes:
First row of each set of three gives the prediction, second row gives the regression coefficient, third row gives the probability of observing the coefficient obtained given the null hypothesis that the parameter estimate is zero. Tests of means are t tests: two tail tests for the intercepts, one tail tests for the response coefficients. Test of medians are nonparametric sign tests: two tail tests for the intercepts, one tail tests for the response coefficients.
ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.
Proxies:
Returns are two day returns over the announcement window.
Earnings are unexpected earnings scaled by firm value at the end of the quarter. Expected earnings are the prior quarter earnings plus the change in the same quarter a year ago.
Dividends are unexpected dividends scaled by firm value at the end of the quarter. Expected dividends are the prior quarter dividends plus the change in the same quarter a year ago.

Table B.58: Constructs, proxies, and predicted coefficients for tests of the variation in the announcement date response coefficients

Theoretical model		Empirical model	
Construct	Coefficient	Proxy	Coefficient
Dividend response coefficient		Returns / unexpected dividends	
Earnings response coefficient		Returns / unexpected earnings	
Dividend payout ratio	–	Dividends / net income	–
Discount rate (risk)	–	Market model beta	–
Discount rate (interest)	–	Yield on 10 year government bonds	–
Tax rate	–	Biennium	1986-87 largest
Growth rate	+	Growth in quarterly dividends	+

Table B.59: Evidence on the effect of the relative timing of dividend and earnings announcements on the dividend and earnings response coefficients, where the response coefficients are measured as returns divided by the unexpected change in dividends or earnings

	Mean	St D	Prob0	Prob1	Q1	Q2	Q3	Prob2	Prob3	Obs
ERC_0	1.271	47.898	.0252	.6336	-2.008	0.110	3.571	.0001	.0001	7121
ERC_1	1.849	53.908	.0482	.3641	-2.181	0.122	4.164	.0001	.0001	3321
ERC_2	0.636	44.480	.4801	.6857	-1.806	0.123	2.679	.0001	.0001	2442
DRC_0	11.677	89.330	.0001	.0001	-16.330	2.894	30.623	.0001	.0001	1409
DRC_1	9.874	61.753	.0004	.0014	-12.362	2.894	25.147	.0002	.0031	497
DRC_2	9.514	89.854	.0061	.0141	-19.127	0.108	30.132	.0206	.0991	675
When data restricted to announcements being within two weeks of each other										
ERC_0	2.162	47.851	.0037	.1188	-2.081	0.080	3.756	.0001	.0001	4126
ERC_1	3.139	55.350	.0105	.0809	-2.271	0.048	4.012	.0001	.0001	2042
ERC_2	1.594	42.876	.3168	.7090	-1.858	0.116	2.760	.0269	.0001	726
DRC_0	12.586	101.810	.0006	.0015	-20.473	3.804	31.777	.0007	.0064	780
DRC_1	7.066	52.020	.1129	.1730	-17.850	0.054	24.703	.2015	.3632	138
DRC_2	9.180	97.000	.0575	.0904	-22.284	0.062	28.092	.1185	.2809	405

Notes:
Table provides the predicted value, the mean, the standard deviation, the first, second, and third quartiles, and the number of observations, and the reference for each response coefficient. ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.
Total observations in the sample are 7290 (= 270 firms * 27 quarters). The table excludes cases where scaled unexpected dividends or earnings are between -0.0001 and $+0.0001$.

Table B.60: Descriptive statistics for firm rates and response coefficients

	Mean	St D	Prob0	Prob1	Q1	Q2	Q3	Prob2	Prob3	Obs
Payout rate	0.483	1.679			0.360	0.494	0.641			270
Beta	0.878	0.337			0.664	0.934	1.108			270
Growth rate	1.014	0.016			1.007	1.014	1.024			270
Mean ERC$_0$	1.312	9.224	.0202	.5787	-1.357	0.853	3.797	.0004	.9960	270
Median ERC$_0$	0.708	2.352	.0001	.0422	-0.010	0.123	0.734	.0001	.0001	270
Mean DRC$_0$	11.784	47.132	.0001	.0002	-5.901	6.328	26.091	.0001	.0001	266
Median DRC$_0$	8.697	38.368	.0003	.0012	-4.579	4.278	19.844	.0001	.0004	266
Mean ERC$_1$	2.078	15.152	.0533	.3146	-2.843	0.574	5.091	.0479	.8644	201
Median ERC$_1$	1.338	8.404	.0251	.5696	-0.134	0.133	1.126	.0001	.0001	201
Mean DRC$_1$	11.524	45.788	.0048	.0098	-7.150	6.086	24.703	.0011	.0045	130
Median DRC$_1$	10.866	47.363	.0100	.0190	-4.540	4.138	22.134	.0049	.0255	130
Mean ERC$_2$	0.182	10.696	.8142	.2919	-1.716	0.336	2.413	.1417	.0175	191
Median ERC$_2$	0.248	5.367	.5244	.0542	-0.434	0.054	0.734	.1149	.0001	191
Mean DRC$_2$	9.881	57.468	.0322	.0539	-10.109	6.607	27.923	.0008	.0029	158
Median DRC$_2$	8.946	52.210	.0328	.0576	-5.361	4.944	24.204	.0016	.0082	158
When data restricted to announcements being within two weeks of each other										
Mean ERC$_0$	1.950	12.999	.0247	.2718	-1.326	1.151	4.389	.0001	.2289	227
Median ERC$_0$	0.730	4.998	.0287	.4174	-0.161	0.114	0.913	.0001	.0001	227
Mean DRC$_0$	12.430	58.533	.0032	.0066	-11.196	5.651	29.837	.0016	.0056	198
Median DRC$_0$	10.394	48.317	.0028	.0068	-7.138	4.332	24.703	.0021	.0124	198
Mean ERC$_1$	1.719	20.543	.2564	.6344	-2.768	0.566	5.441	.0665	.8671	185
Median ERC$_1$	0.541	12.546	.5580	.6196	-0.412	0.116	1.147	.0115	.0001	185
Mean DRC$_1$	5.449	33.616	.2142	.3095	-14.746	0.769	23.678	.4688	.6363	60
Median DRC$_1$	3.246	35.494	.4814	.6258	-22.156	0.000	21.141	.8695	.8729	60
Mean ERC$_2$	1.208	18.252	.4501	.8965	-1.184	0.481	3.073	.0483	.3285	131
Median ERC$_2$	1.850	15.908	.1854	.5417	-0.912	0.101	1.250	.2329	.0001	131
Mean DRC$_2$	8.072	73.886	.2280	.2905	-15.006	7.739	31.050	.0254	.0460	123
Median DRC$_2$	7.721	69.836	.2225	.2880	-5.934	5.633	26.453	.0091	.0292	123

Notes:

The payout rate is calculated as the dividends paid out in 1980 to 1987 divided by net income for 1980 to 1987. Beta is calculated by regressing 1980 to 1987 monthly returns on the CRSP equal weighted market returns. The growth rate is calculated by regressing the logarithm of quarterly dividends for 1980 to 1987 on time.

Table provides the predicted value, the mean, the standard deviation, the first, second, and third quartiles, and the number of observations, and the reference for each variable. ERC$_0$ and DRC$_0$ are calculated without regard to the relative timing of the announcements, ERC$_1$ and DRC$_2$ are calculated from the observations in which earnings are announced before dividends, and ERC$_2$ and DRC$_1$ are calculated from the observations in which earnings are announced after dividends. Mean ERC and DRC are the means of the quarterly ERC and DRC for the firm; median ERC and DRC are the medians of the quarterly ERC and DRC for the firm.

Table B.61: Evidence on the cross-sectional variation in earnings response coefficients, when earnings announced first

$$\text{Response coefficient} = b_0 + b_1 * \text{Dividend payout ratio} + b_2 * \text{Beta} + b_3 * \text{Dividend growth rate}$$

Obs	Case	b_0	b_1	b_2	b_3	Adjusted	White's	Largest
	Predicted		–	–	+	R^2	χ^2	VIF
All	Mean ERC_1	-13.032	0.047	-2.657	17.316	.0000	.2835	1.024
201		.851	.528	.222	.400			
All	Median ERC_1	-33.881	-0.054	-3.826	38.249	.0117	.8756	1.024
201		.374	.441	.023	.154			
Pos	Mean ERC_1	-142.011	0.197	-1.131	149.824	.0000	.8837	1.066
113		.134	.514	.411	.053			
Pos	Median ERC_1	-64.711	-2.754	-6.137	73.878	.0415	.9958	1.112
126		.225	.234	.014	.077			
Log	Mean ERC_1	0.809	0.541	0.266	24.230	.0621	.3029	1.026
113		.001	.866	.816	.002			
Log	Median ERC_1	0.182	-3.250	0.272	42.726	.1551	.3791	1.082
126		.734	.004	.748	.000			
When data restricted to announcements being within two weeks of each other								
All	Mean ERC_1	-29.817	0.192	-1.264	32.194	.0000	.2359	1.026
185		.770	.583	.398	.374			
All	Median ERC_1	7.273	0.122	-5.398	-1.698	.0031	.6874	1.025
185		.906	.587	.036	.511			
Pos	Mean ERC_1	-224.120	-1.260	-0.179	232.240	.0234	.7873	1.059
104		.034	.420	.488	.012			
Pos	Median ERC_1	-104.186	-3.249	-9.288	117.032	.0691	.9804	1.068
106		.134	.244	.004	.042			
Log	Mean ERC_1	0.826	0.454	0.316	29.806	.0862	.7637	1.022
104		.002	.808	.827	.001			
Log	Median ERC_1	0.456	-3.581	-0.419	46.928	.1510	.1224	1.044
106		.434	.004	.194	.000			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent varaiables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each firms' earnings response coefficients was the dependent variable; median indicates that the median of each firms' earnings response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table B.62: Evidence on the cross-sectional variation in dividend response coefficients, when dividends announced first

$$\text{Response coefficient} = b_0 + b_1 * \text{Dividend payout ratio} + b_2 * \text{Beta} + b_3 * \text{Dividend growth rate}$$

Obs	Case	b_0	b_1	b_2	b_3	Adjusted	White's	Largest
	Predicted		−	−	+	R^2	χ^2	VIF
All	Mean DRC_1	-215.588	-1.499	-1.159	225.134	.0000	.5185	1.057
130		.400	.232	.464	.186			
All	Median DRC_1	-155.500	-1.632	-4.319	167.836	.0000	.3072	1.057
130		.557	.220	.371	.260			
Pos	Mean DRC_1	-657.804	-18.730	1.984	687.879	.0500	.6245	1.588
79		.098	.219	.546	.035			
Pos	Median DRC_1	-723.467	-15.506	15.370	741.970	.0648	.4692	1.634
74		.097	.260	.787	.038			
Log	Mean DRC_1	3.302	-2.361	-0.333	21.482	.0838	.5458	1.566
79		.000	.050	.197	.054			
Log	Median DRC_1	3.689	-2.861	0.669	15.526	.1062	.6776	1.636
74		.000	.059	.909	.192			
When data restricted to announcements being within two weeks of each other								
All	Mean DRC_1	-126.837	-1.826	-2.613	132.793	.0000	.4071	1.081
60		.588	.120	.422	.282			
All	Median DRC_1	-72.944	-1.966	-4.119	78.681	.0000	.5246	1.081
60		.768	.116	.384	.373			
Pos	Mean DRC_1	-398.356	-37.653	-5.214	444.466	.1173	.4624	1.256
31		.165	.063	.374	.055			
Pos	Median DRC_1	-450.582	-67.304	-19.037	523.698	.2224	.8278	1.271
28		.163	.012	.162	.049			
Log	Mean DRC_1	5.177	-6.820	-0.179	5.898	.1316	.8573	1.318
31		.000	.012	.413	.387			
Log	Median DRC_1	5.974	-8.794	-0.037	4.942	.2161	.5485	1.327
28		.000	.005	.483	.410			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent varaiables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each firms' dividend response coefficients was the dependent variable; median indicates that the median of each firms' dividend response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table B.63: Evidence on the cross-sectional variation in dividend response coefficients, when dividends announced second

$$\text{Response coefficient} = b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} + b_3 * \text{Dividend growth rate}$$

Obs	Case	b_0	b_1	b_2	b_3	Adjusted	White's	Largest
	Predicted		−	−	+	R^2	χ^2	VIF
All	Mean DRC_2	-324.897	-20.504	0.634	339.214	.0000	.3957	1.459
158		.358	.222	.514	.168			
All	Median DRC_2	-381.689	-7.123	1.370	387.123	.0000	.3079	1.459
158		.236	.384	.536	.104			
Pos	Mean DRC_2	-805.598	-27.161	-2.016	841.756	.0716	.5551	1.570
102		.038	.159	.450	.012			
Pos	Median DRC_2	-828.384	-25.956	-7.541	866.528	.0705	.5871	1.449
93		.028	.168	.330	.009			
Log	Mean DRC_2	3.111	-1.878	0.047	28.542	.1582	.6091	1.592
102		.000	.045	.564	.002			
Log	Median DRC_2	2.903	-1.913	-0.418	27.969	.0792	.7597	1.479
93		.000	.088	.169	.012			
When data restricted to announcements being within two weeks of each other								
All	Mean DRC_2	-643.934	-28.152	-28.678	682.140	.0138	.7387	1.494
123		.224	.231	.126	.090			
All	Median DRC_2	-844.500	-4.887	-23.816	863.469	.0181	.7390	1.494
128		.091	.446	.157	.036			
Pos	Mean DRC_2	-946.288	-55.794	-24.753	1018.239	.0755	.5668	1.819
75		.083	.108	.150	.026			
Pos	Median DRC_2	-1054.846	-41.848	-22.278	1113.094	.0908	.6421	1.618
74		.027	.147	.157	.008			
Log	Mean DRC_2	3.536	-2.503	-0.384	24.786	.1389	.5344	1.769
75		.000	.035	.119	.012			
Log	Median DRC_2	3.034	-2.420	-0.778	30.594	.0771	.6579	1.552
74		.001	.108	.058	.023			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent varaiables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each firms' dividend response coefficients was the dependent variable; median indicates that the median of each firms' dividend response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table B.64: Evidence of variation in the response coefficients due to cross sectional variation in firm payout rates, firm betas, and firm dividend growth rates: probability (1 tail) of observing the difference in the mean (t test) or the mean rank (Wilcoxon test) of the response coefficients between the first and fourth quartiles of the rates, given the null hypotheses of no difference.

	All announcements				Announcements within 2 weeks of each other			
	Mean		Median		Mean		Median	
	t test	W test	t test	W test	t test	W test	t test	Wilcoxon test
Effect on the response coefficients of changes in the dividend payout rate								
ERC_0	.001	.001	.001	.001	.002	.001	.056	.284
ERC_1	.075	.180	.035	.019	.313	.125	.762	.221
ERC_2	.045	.145	.273	.304	.069	.175	.080	.614
DRC_0	.002	.008	.023	.254	.004	.013	.013	.234
DRC_1	.778	.833	.786	.843	.436	.864	.394	.912
DRC_2	.049	.013	.193	.288	.196	.075	.406	.420
Effect on the response coefficients of changes in the beta								
ERC_0	.524	.705	.734	.976	.712	.889	.141	.748
ERC_1	.138	.401	.128	.535	.231	.699	.069	.536
ERC_2	.428	.783	.744	.820	.694	.935	.914	.929
DRC_0	.889	.691	.798	.487	.582	.277	.562	.458
DRC_1	.510	.497	.328	.254	.132	.149	.149	.289
DRC_2	.887	.793	.863	.466	.426	.270	.435	.109
Effect on the response coefficients of changes in the dividend growth rate								
ERC_0	.005	.004	.006	.010	.008	.009	.027	.112
ERC_1	.194	.173	.172	.077	.352	.118	.479	.118
ERC_2	.012	.034	.557	.423	.010	.007	.212	.357
DRC_0	.001	.004	.003	.006	.001	.006	.001	.015
DRC_1	.196	.282	.281	.496	.346	.500	.465	.705
DRC_2	.077	.036	.049	.034	.029	.054	.009	.031

Notes:
Mean indicates the mean of each firm's response coefficients; median indicates the median of each firm's response coefficients.
ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.

Table B.65: Descriptive statistics for quarter rates and response coefficients

	Mean	St D	Prob0	Prob1	Q1	Q2	Q3	Prob2	Prob3	Obs
Interest rate	11.037	2.166			9.12	11.12	12.45			27
Mean ERC_0	1.284	3.380	.0592	.6664	-0.620	0.667	1.920	.0706	.6398	27
Median ERC_0	0.199	0.229	.0001	.0001	0.003	0.103	0.347	.0001	.0001	27
Mean DRC_0	12.688	15.354	.0002	.0005	-0.454	9.231	17.836	.0001	.0001	27
Median DRC_0	3.957	4.748	.0002	.0033	0.000	3.021	7.344	.0001	.0068	27
Mean ERC_1	1.766	6.609	.1767	.5521	-1.458	0.910	2.561	.1602	.9070	27
Median ERC_1	0.210	0.333	.0030	.0001	0.000	0.106	0.333	.0001	.0001	27
Mean DRC_1	12.646	22.386	.0069	.0119	-0.321	11.386	20.773	.0062	.0132	27
Median DRC_1	5.158	8.883	.0056	.0222	0.000	3.917	12.148	.0035	.0208	27
Mean ERC_2	0.702	3.947	.3638	.6981	-1.402	0.661	2.220	.2667	.6231	27
Median ERC_2	0.166	0.334	.0158	.0001	0.006	0.161	0.402	.0028	.0001	27
Mean DRC_2	9.399	19.439	.0185	.0335	-4.251	6.648	22.894	.0180	.0411	27
Median DRC_2	2.626	11.263	.2367	.4600	-3.954	0.042	7.376	.4107	.6231	27
When data restricted to announcements being within two weeks of each other										
Mean ERC_0	2.158	6.274	.0856	.3464	-0.858	0.974	2.449	.0560	.8886	27
Median ERC_0	0.193	0.318	.0040	.0001	0.000	0.024	0.337	.0001	.0001	27
Mean DRC_0	14.321	24.356	.0051	.0086	2.104	8.720	24.420	.0036	.0074	27
Median DRC_0	4.943	9.962	.0159	.0499	0.000	4.126	11.126	.0088	.0338	27
Mean ERC_1	2.866	8.452	.0898	.2617	-1.426	2.170	4.384	.0338	.3972	27
Median ERC_1	0.224	0.377	.0048	.0001	0.000	0.023	0.486	.0008	.0001	27
Mean DRC_1	13.700	32.354	.0448	.0614	-11.630	2.403	29.333	.1884	.2611	25
Median DRC_1	11.981	31.059	.0657	.0898	-3.982	0.846	12.332	.2497	.4706	25
Mean ERC_2	2.042	8.776	.2375	.5426	-2.037	0.066	3.479	.5740	.6737	27
Median ERC_2	0.213	0.839	.1985	.0001	-0.134	0.164	0.476	.0915	.0001	27
Mean DRC_2	9.254	25.566	.0712	.1054	-8.436	5.970	20.474	.0747	.1143	27
Median DRC_2	3.654	16.309	.2549	.4055	-3.679	0.019	6.250	.3509	.8701	27

Notes:

Table provides the mean, the standard deviation, the (two tail) probability of observing the mean given the null hypothesis that the mean is zero (Prob0) or one (Prob1), the first, second, and third quartiles, the (two tail) probability of observing the median given the null hypothesis that the median is zero (Prob2) or one (Prob3), and the number of observations, and the reference for each response coefficient, where the response coefficient is calculated as returns divided by unexpected earnings or dividends.

ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.

Mean ERC and DRC are the means of the firm ERC and DRC for the quarter; median ERC and DRC are the medians of the firm ERC and DRC for the quarter.

Table B.66: Evidence on the time series variation in earnings response coefficients, when earnings announced first

Response coefficient $= b_0 + b_1 * \text{Interest rate}$

Obs	Case Predicted	b_0	b_1 –	Adjusted R^2	White's χ^2
All	Mean ERC_1	6.094	-0.392	.0000	.1784
27		.379	.261		
All	Median ERC_1	-0.088	0.027	.0000	.4728
27		.799	.809		
Pos	Mean ERC_1	16.681	-1.107	.0675	.5256
17		.072	.081		
Pos	Median ERC_1	0.027	0.024	.0000	.3594
20		.949	.736		
Log	Mean ERC_1	8.292	-3.136	.2786	.8350
17		.010	.009		
Log	Median ERC_1	0.501	-1.088	.0000	.1442
20		.918	.296		
When data restricted to announcements being within two weeks of each other					
All	Mean ERC_1	8.134	-0.477	.0000	.3871
27		.359	.272		
All	Median ERC_1	-0.163	0.036	.0022	.7930
27		.674	.843		
Pos	Mean ERC_1	16.899	-1.021	.0001	.4092
18		.166	.166		
Pos	Median ERC_1	0.116	0.024	.0000	.8207
16		.852	.670		
Log	Mean ERC_1	3.709	-1.089	.0000	.4824
18		.253	.207		
Log	Median ERC_1	-3.246	0.490	.0000	.7389
16		.667	.563		

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each quarter's earnings response coefficients was the dependent variable; median indicates that the median of each quarter's earnings response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table B.67: Evidence on the time series variation in dividend response coefficients, when dividends announced first

Response coefficient $= b_0 + b_1 *$ Interest rate

Obs	Case Predicted	b_0	b_1 –	Adjusted R^2	White's χ^2
All	Mean DRC_1	43.240	-2.772	.0348	.3610
27		.064	.088		
All	Median DRC_1	19.641	-1.312	.0664	.1033
27		.034	.052		
Pos	Mean DRC_1	58.076	-3.294	.0861	.4230
19		.019	.059		
Pos	Median DRC_1	33.390	-2.232	.4379	.1343
19		.000	.001		
Log	Mean DRC_1	7.058	-1.826	.0976	.4188
19		.013	.052		
Log	Median DRC_1	9.514	-3.418	.0667	.2990
19		.095	.074		
When data restricted to announcements being within two weeks of each other					
All	Mean DRC_1	94.141	-7.236	.1916	.0358
25		.007	.008		
All	Median DRC_1	99.304	-7.856	.2572	.0207
25		.002	.003		
Pos	Mean DRC_1	116.700	-8.131	.1988	.0793
15		.014	.027		
Pos	Median DRC_1	137.786	-10.591	.3031	.0321
14		.008	.012		
Log	Mean DRC_1	12.119	-4.087	.1285	.9166
15		.046	.052		
Log	Median DRC_1	13.968	-5.063	.1297	.5421
14		.065	.056		

Notes:
Obs gives number of quarter's used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each quarter's dividend response coefficients was the dependent variable; median indicates that the median of each quarter's dividend response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table B.68: Evidence on the time series variation in dividend response coefficients, when dividends announced second

Response coefficient $= b_0 + b_1 *$ Interest rate

Obs	Case Predicted	b_0	b_1 –	Adjusted R^2	White's χ^2
All	Mean DRC_2	55.586	-4.184	.1860	.1813
27		.004	.007		
All	Median DRC_2	15.170	-1.137	.0097	.2181
27		.196	.137		
Pos	Mean DRC_2	64.049	-4.261	.3330	.0833
19		.000	.003		
Pos	Median DRC_2	34.342	-2.289	.1957	.4100
15		.014	.028		
Log	Mean DRC_2	8.369	-2.472	.2488	.4433
19		.001	.009		
Log	Median DRC_2	9.369	-3.361	.0436	.2894
15		.157	.111		
When data restricted to announcements being within two weeks of each other					
All	Mean DRC_2	66.416	-5.179	.1602	.2243
27		.010	.011		
All	Median DRC_2	20.324	-1.510	.0018	.3610
27		.232	.158		
Pos	Mean DRC_2	91.717	-6.400	.4897	.3698
17		.000	.001		
Pos	Median DRC_2	41.931	-2.740	.0658	.2924
14		.081	.096		
Log	Mean DRC_2	13.134	-4.558	.2278	.1746
17		.010	.016		
Log	Median DRC_2	4.469	-1.253	.0000	.7953
14		.444	.304		

Notes:
Obs gives number of quarter's used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each quarter's dividend response coefficients was the dependent variable; median indicates that the median of each quarter's dividend response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table B.69: Evidence of variation in the response coefficients due to time series variation in the risk free interest rate and the effective tax rate on dividends: probability (1 tail) of observing the difference in the mean (t test) or the mean rank (Wilcoxon test) of the response coefficients between the first and fourth quartiles of the rates, given the null hypotheses of no difference.

	All announcements				Announcements within 2 weeks of each other			
	Mean		Median		Mean		Median	
	t test	W test	t test	W test	t test	W test	t test	Wilcoxon test
Effect on the response coefficients of changes in the interest rate								
ERC_0	.227	.186	.879	.899	.347	.500	.847	.938
ERC_1	.476	.399	.811	.649	.511	.551	.916	.958
ERC_2	.058	.153	.386	.449	.332	.649	.666	.874
DRC_0	.008	.008	.161	.186	.009	.011	.160	.153
DRC_1	.096	.101	.127	.101	.061	.087	.053	.064
DRC_2	.020	.028	.140	.126	.017	.014	.154	.222
Effect on the response coeficients of changes in the effective tax rate on dividends								
ERC_0	.102	.094	.894	.922	.156	.396	.841	.974
ERC_1	.186	.247	.793	.682	.199	.437	.814	.679
ERC_2	.221	.437	.508	.479	.124	.479	.512	.814
DRC_0	.002	.003	.024	.033	.006	.006	.046	.042
DRC_1	.030	.026	.056	.052	.020	.021	.022	.021
DRC_2	.016	.016	.123	.094	.021	.007	.127	.136

Notes:

Mean indicates the mean of each quarter's response coefficients; median indicates the median of each quarter's response coefficients.

ERC_0 and DRC_0 are calculated without regard to the relative timing of the announcements, ERC_1 and DRC_2 are calculated from the observations in which earnings are announced before dividends, and ERC_2 and DRC_1 are calculated from the observations in which earnings are announced after dividends.

Table B.70: Evidence on the time series variation in earnings response coefficients, when earnings announced first

Response coefficient $= b_0 + b_1 *$ Interest rate $+ b_2 *$ Tax rate dummy

Obs	Case	b_0	b_1	b_2	Adjusted	White's	Largest
	Predicted		$-$	$+$	R^2	χ^2	VIF
All	Mean ERC_1	-262.209	2.251	2.849	.0339	.6223	4.899
16		.150	.886	.071			
All	Median ERC_1	-7.066	0.108	0.072	.1104	.7298	4.899
16		.256	.947	.137			
Pos	Mean ERC_1	-271.522	1.574	3.078	.1237	.7495	4.796
11		.214	.763	.094			
Pos	Median ERC_1	-10.156	0.121	0.108	.0931	.6045	4.542
13		.160	.958	.082			
Log	Mean ERC_1	-37.391	1.107	0.423	.2863	.2508	5.389
11		.303	.624	.108			
Log	Median ERC_1	-52.580	3.314	0.504	.0000	.3004	5.676
13		.303	.754	.147			
When data restricted to announcements being within two weeks of each other							
All	Mean ERC_1	-307.414	2.617	3.354	.0069	.8426	4.899
16		.189	.861	.090			
All	Median ERC_1	-9.026	0.138	0.092	.1546	.9129	4.899
16		.212	.962	.114			
Pos	Mean ERC_1	-360.081	2.321	4.046	.0301	.7483	5.179
11		.270	.762	.123			
Pos	Median ERC_1	-5.734	0.089	0.061	.0000	.6744	5.439
10		.641	.758	.321			
Log	Mean ERC_1	-34.441	2.091	0.362	.0000	.3234	5.804
11		.461	.678	.203			
Log	Median ERC_1	-0.846	0.808	-0.034	.0000	.4459	6.156
10		.990	.548	.522			

Notes:

Obs gives number of quarter's used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each quarter's earnings response coefficients was the dependent variable; median indicates that the median of each quarter's earnings response coefficients was the dependent variable.

The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

The tax rate dummy is 0 for quarters 1981:2 to 1983:1 and 1 for quarters 1986:1 to 1987:4. Quarters 1983:2 to 1985:4 were excluded from the data.

Table B.71: Evidence on the time series variation in dividend response coefficients, when dividends announced first

Response coefficient $= b_0 + b_1 *$ Interest rate $+ b_2 *$ Tax rate dummy

Obs	Case	b_0	b_1	b_2	Adjusted	White's	Largest
	Predicted		$-$	$+$	R^2	χ^2	VIF
All	Mean DRC_1	-216.156	-1.376	2.839	.1305	.3306	4.899
16		.613	.378	.267			
All	Median DRC_1	-137.581	-0.038	1.683	.0621	.2595	4.899
16		.517	.493	.229			
Pos	Mean DRC_1	15.638	-3.804	0.540	.4387	.4611	5.372
10		.963	.143	.441			
Pos	Median DRC_1	-135.002	-0.766	1.803	.7150	.5254	8.486
9		.411	.309	.156			
Log	Mean DRC_1	6.983	-2.299	0.014	.6037	.4657	5.737
10		.666	.081	.463			
Log	Median DRC_1	-145.664	8.484	1.498	.4800	.3611	8.140
9		.094	.876	.036			
When data restricted to announcements being within two weeks of each other							
All	Mean DRC_1	-1003.209	2.952	11.668	.2714	.0439	4.578
15		.169	.654	.068			
All	Median DRC_1	-784.271	0.670	9.387	.2539	.0857	4.578
15		.272	.546	.109			
Pos	Mean DRC_1	-3706.686	29.560	40.411	.3335	.2418	17.684
7		.172	.872	.081			
Pos	Median DRC_1	-4018.247	31.416	43.841	.2647	.2859	12.481
6		.194	.869	.093			
Log	Mean DRC_1	-116.671	8.097	1.184	.2369	.5390	12.528
7		.263	.807	.114			
Log	Median DRC_1	-101.900	7.001	1.044	.4394	.3354	8.487
6		.156	.880	.067			

Notes:
Obs gives number of quarter's used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each quarter's dividend response coefficients was the dependent variable; median indicates that the median of each quarter's dividend response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)
The tax rate dummy is 0 for quarters 1981:2 to 1983:1 and 1 for quarters 1986:1 to 1987:4. Quarters 1983:2 to 1985:4 were excluded from the data.

Table B.72: Evidence on the time series variation in dividend response coefficients, when dividends announced second

Response coefficient $= b_0 + b_1 *$ Interest rate $+ b_2 *$ Tax rate dummy

Obs	Case	b_0	b_1	b_2	Adjusted	White's	Largest
	Predicted		−	+	R^2	χ^2	VIF
All	Mean DRC_2	-277.551	-0.737	3.561	.1939	.3543	4.899
16		.467	.426	.193			
All	Median DRC_2	-145.180	0.370	1.752	.0000	.2889	4.899
16		.566	.556	.258			
Pos	Mean DRC_2	43.593	-3.942	0.242	.2834	.3277	5.972
12		.907	.178	.476			
Pos	Median DRC_2	87.750	-2.728	-0.560	.0444	.6950	5.714
11		.770	.218	.571			
Log	Mean DRC_2	8.821	-2.318	-0.006	.3633	.5921	6.338
12		.655	.134	.514			
Log	Median DRC_2	16.044	-2.714	-0.089	.2054	.3697	6.319
11		.443	.118	.682			
When data restricted to announcements being within two weeks of each other							
All	Mean DRC_2	-520.293	1.007	6.260	.1839	.7165	4.899
16		.299	.578	.121			
All	Median DRC_2	-343.439	1.726	3.937	.0000	.6431	4.899
16		.419	.653	.193			
Pos	Mean DRC_2	-377.368	-1.623	4.977	.5602	.2087	7.022
13		.357	.356	.127			
Pos	Median DRC_2	-734.589	5.300	8.180	.0000	.5278	17.758
10		.536	.670	.257			
Log	Mean DRC_2	-75.697	3.562	0.824	.3331	.1459	7.463
13		.210	.727	.071			
Log	Median DRC_2	-128.240	12.280	1.199	.0861	.3414	17.664
10		.141	.931	.069			

Notes:
Obs gives number of quarter's used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. Mean indicates that the mean of each quarter's dividend response coefficients was the dependent variable; median indicates that the median of each quarter's dividend response coefficients was the dependent variable.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)
The tax rate dummy is 0 for quarters 1981:2 to 1983:1 and 1 for quarters 1986:1 to 1987:4. Quarters 1983:2 to 1985:4 were excluded from the data.

Appendix C

ADDITIONAL EMPIRICAL EVIDENCE ON VARIATION IN THE ANNUAL DIVIDEND RESPONSE COEFFICIENT

The appendices provides empirical tests of the hypotheses supplemental to that in section 3.5.

C.1 Tests of hypothesis H1 using 1984-88 data on 56 firms

This section provides empirical evidence on the relation between firm value, nonoperating assets, operating cash flow, dividends, and the payout rate supplemental to that in section 3.5.1. That section used annual data for 1980 to 1987. This section uses data for 1984 to 1988.

C.1.1 Proxies

As noted in table C.1, the proxy for firm value is the market value of the firm's common shares on March 31, 1984. The proxy for dividends is regular quarterly taxable dividends paid in U.S. dollars on common stock from December 1, 1983 to February 29, 1988. Other distributions were not used since it was not clear how to value them in relation to regular dividends.

Proxies for the accounting variables are given in table C.1. Cash and short term investments (Compustat item D36) proxied for nonoperating assets. The proxies for cash flow constructs are the corresponding income statement amounts. In the absence of growth, the model states that cash flow amounts and earnings amounts are the same; in the presence of growth they differ by the difference between opening and closing operating assets. Since it was not clear how much growth the sample firms were experiencing nor was it clear which balance sheet items should be classified as operating assets, it seemed appropriate to simply not adjust the income statement amounts rather than to attempt to make adjustments which might introduce more error than they eliminated. Operating income (Compustat item D21) for the five year period January 1, 1984 to December 31, 1988 proxied for expected operating cash flow. The sensitivity of the regression results to the use of this proxy was checked by also using operating income less depreciation and amortization (Compustat item D5), net income (Compustat item D69) less preferred dividends (Compustat item D24), and income before extra-ordinary items (Compustat item D8) less preferred dividends.

C.1.2 The sample

The sample consists of firms listed on both the Compustat quarterly industrial database and the CRSP monthly NYSE database that met certain criteria. As noted in table C.2, the 56 sample firms are those on the CRSP and Compustat tapes with calendar quarter year ends, with a full set of regular quarterly dividend and earnings announcements, with operating income for each quarter, and with returns for the twenty quarters. Firms that paid dividends on other than a quarterly basis, or stock dividends or splits or any other kind of distribution other than a taxable U.S. dollar cash dividend during the period were excluded. Tables C.3 and C.4 provide correlations and summary statistics for the sample data.

C.1.3 Statistical procedures

The equations were tested using ordinary least squares. The significance of the parameter estimates was tested using standard student t tests.

C.1.4 Results

Tables C.3, C.4, and C.5 relate to testing the model's predictions regarding the *level* of firm value. Table C.3 reports the correlation matrix for the variables used to test the equation. The proxy for operating funds flow, operating income for 1984-88, and its alternate, operating income for 1984-88 less depreciation, are highly (96%) correlated, as are the proxy for total funds flow, 1984-88 net income, and its alternate, 1984-88 income before extraordinary items. The correlation among these four income statement items ranges from 78 to 86%. Price is highly correlated with the operating and nonoperating variables and with its lagged value. It is much less highly correlated with 1984-88 dividends.

Table C.5 reports tests of the variables determining the level of firm value. It shows the results of regressing the March 31 1984 stock market price on December 31 1983 cash and equivalents per share, 1984-88 operating income per share, 1984-88 dividends per share, the ratio of 1984-88 dividends to 1984-88 operating income, and the square of the ratio.

Panel A of table C.5 shows that the parameter estimates for regression 3.3 have the predicted signs. However, the coefficient on dividends is insignificantly different from zero, the coefficient on operating income is significantly less than one, and the coefficient on nonoperating assets is significantly greater than one, all contrary to the model's predictions. The presence of a large intercept term is also troubling. Using operating income less depreciation instead of operating income does not significantly affect the regression results. Using instead income before extraordinary items or net income results in the coefficient on this variable moving closer to one and the coefficient on nonoperating assets becoming insignificant, but also produces a positive parameter estimate for dividends not significantly different from one. Using the actual quarterly data on a time series or cross-sectional or pooled basis rather than the data summed over the full five years produces similar, though less statistically significant, results.

Panel B of table C.5 shows that the parameter estimates for regression 3.3 modified to include the payout rate and its square have the predicted signs. Moreover, although the parameter estimate for operating income remains significantly less than one, that for dividends is now significantly negative and that for nonoperating assets is not significantly different from one, as hypothesized. Replacing operating income by operating income less depreciation, income before extraordinary items, or net income produces similar results, though the parameter estimates for dividends, nonoperating assets, and the ratio squared terms move increasingly to zero as each of these substitutions is made.

C.1.5 Summary

The tests in table C.5 support the model's predictions of the determinants of the *level* of firm value. The signs of the coefficients on the proxies agree with those on the constructs in the equations, and the magnitudes are not inconsistent. The results complement those in section 3.5.1 and indicate that they are robust with respect to different time periods and different proxies.

C.2 Tests of hypotheses H3 to H5

This section reports additional tests of hypotheses H3, H4, and H5, using the same sample as in section 3.5.3. The tests also examine the effect of using the operating cash flow growth rate, estimated by regressing the log of operating cash flow on the calendar year, to proxy for growth rather than using the dividend growth rate.

C.2.1 Univariate tests

Table C.6 reports the results of rank tests of the variation in the dividend response coefficient. The results are reported for the DRCs calculated with intercept (as shown in table 3.14) and without intercept (as in table 3.15). The t test evaluates whether the mean of the DRC in the first quartile of the independent variable is significantly different from the mean of the DRC in the fourth quartile; the Wilcoxon test reports whether the mean rank of the DRC in the first quartile is significantly different from the mean rank in the fourth quartile.

The DRCs in the first quartile of the dividend payout rate are significantly higher than the DRCs in the fourth quartile under both tests and both estimations of the DRC, as predicted by hypothesis H3. The DRCs calculated without an intercept term are significantly lower in the first beta quartile than in the fourth, contrary to hypothesis H4, while the DRCs calculated with an intercept term are significantly higher in the first quartile than the fourth, as predicted. The DRCs in the first growth quartiles are lower than those in the fourth quartile as predicted in hypothesis H5, though the relation is significant in only half the cases.

C.2.2 Multivariate regression tests

Table C.7 reports the results of the cross-sectional regressions (equation # 3.4) of the dividend response coefficients on the proxies for the payout rate, the risk rate, and the growth rate. Dividend response coefficients were calculated with and without intercept terms, the regressions were performed with and without a logarithm transformation, and growth was proxied by growth in dividends and growth in operating cash flow; thus there are 2 * 2 * 2 = 8 regressions. The R^2 statistic suggest that the proxies explain about 20% of the DRC variations when the DRC was calculated without an intercept, but none of the variation when the intercept was used.

The regression coefficient for the dividend payout rate is consistently negative as predicted by hypothesis H3, though significantly so only when the variables in the regression are not transformed by logarithm and the dividend response coefficient was obtained in regressions with the intercept suppressed. The coefficient for the firm's beta is consistently negative when the DRC is calculated using an intercept term, as predicted by hypothesis H4, but it is consistently positive contrary to prediction when the intercept term is suppressed. The coefficient on the growth term is generally positive, as predicted by hypothesis H5, and significantly so when the response coefficients were obtained in regressions with the intercept suppressed.

C.2.3 Summary

In summary, the tests indicate that higher dividend payout rates are associated with lower dividend response coefficients, in accordance with hypothesis H3. The relation is significant in all the rank tests, but only a few of the regressions. The evidence on the relation between firms' betas and their dividend response coefficients is mixed. In some tests the relation was direct, in others inverse. The tests indicate that higher growth rates are associated with higher dividend response coefficients as predicted by hypothesis H5. About half of these tests are significant.

C.3 Tests of hypothesis H6

This section discusses tests of hypothesis H6 additional to those reported in section 3.5.4. Tables 3.18 and 3.19 reported the results of regressing equation 3.2 using annual data with returns measured over the period January 1 to December 31. This section reports the results of additional tests incorporating the following changes:

- returns measured over the period March 1 to February 28;

- using quarterly rather than annual data.

C.3.1 Tests using annual returns for March 1 to February 28

Table C.8 provides descriptive statistics for the regression variables for the case when returns are measured from March 1 to February 28. The returns are similar to those in table 3.7 where the association period is January 1 to December 31. Scaled cash and investments, operating cash flow, and change in dividends are slightly smaller than in that table due to common share prices generally increasing in the 1980s.

Table C.9 reports the results of the regressions when the dependent variable is the return over the period March 1 to February 28 of each year. The estimated intercepts are significant in most of the regressions, contrary to prediction. The coefficients on cash and investments are significantly positive only for the time series regressions, and these coefficients are larger than predicted. The coefficients on operating cash flow are similar to those in the regressions in which returns were measured over the period January 1 to December 31: all are significantly positive, but the ones estimated using the pooled data or the cross-sectional regressions are lower than the predicted value of +1. The dividend response coefficients are all insignificant, and many are negative, contrary to prediction.

Table C.10 reports the regression results when returns are measured over months 3 to 14 and the intercept is constrained to zero. The coefficients on cash and investments are significantly positive, but the time series regression coefficients are significantly greater than the predicted amount. The operating cash flow coefficients are significantly positive as predicted, but are still more than 25% less than the predicted amount. The estimated dividend response coefficients are insignificant or significantly negative, contrary to prediction.

In summary, the estimated intercepts are negative for the time series regressions and positive for the pooled and cross-sectional regressions. The estimated coefficients on cash and investments are generally significantly positive as predicted, but the time series coefficients are larger than the predicted value. The coefficients on operating cash flow are significantly positive as predicted, but are lower than the predicted value of +1. The estimated dividend response coefficients are significantly positive as predicted for the time series regressions using returns over months 1 to 12 and intercepts, are significantly negative for the time series regression using return over months 3 to 14 and no intercepts, and are insignificant otherwise.

C.3.2 Tests using 1981-87 quarterly data on 270 firms

This section examines empirically the relation between nonoperating assets, cash flow from operations, the change in dividends, and the cum dividend change in firm value. Section 3.5.4 used annual data, this section uses quarterly data.

Proxies

The proxies for firm value, nonoperating assets, operating cash flows, and dividends are the same as those used in the tests reported in section 3.5.4, except that the proxy for nonoperating assets is cash and short term investments only, since long term investments are not available as a separate item on the Compustat quarterly database. In the model dividends and earnings are announced and firm value is determined at the end of each operating period. Since publicly traded corporations usually make such announcements quarterly, quarterly data is used for the tests in this section, and the change in the market value of the firm's common stock over the quarter proxies for the change in firm value. Earnings are announced several weeks after the quarter ends, and dividends may be announced at any time in the quarter. An alternate proxy for the change in firm value is the change in the market value of the firm's common stock measured over months two to four rather over months one to three (the quarter itself).

The model would permit the terms for nonoperating assets and operating cash flows to be replaced by cash flow from both the operating and nonoperating segments of the firm, with a predicted regression coefficient of one. A proxy for this construct would be primary earnings per share including extraordinary items (which is calculated after deducting preferred dividends) less the increase in non-cash net assets (i.e. total assets less accounts and taxes payable and other non-debt current liabilities) per share.

As recommended by Christie (1987), the variables were scaled by the firm's opening market value to reduce possible problems with heteroscedasticity. Adjustments were made for post 1979 stock splits and dividends.

Substituting the proxies into the regression gives:

$$RET_t = b_0 + b_1 CI_t + b_2 OCF_t + b_3 DIVCHG_t + e_t \tag{C.1}$$

where

RET_t is the cum dividend return on the firm's common shares over the quarter,
CI_t is the firm's cash and investments at the beginning of the quarter,
OCF_t is the firm's operating cash flow over the quarter,
$DIVCHG_t$ is the increase in the firm's common share dividends for the quarter over those for the preceding quarter, and
e_t is the residual term with mean zero.
The three independent variables are scaled by the market value of the firm's common shares at the beginning of the quarter.

Predictions and limitations

If perfect proxies for the model's constructs were available, then the predicted regression coefficients would be:

$$\begin{aligned} b_0 &= 0 \\ b_1 &\in (0,1) \\ b_2 &= 1 \\ b_3 &> 1 \end{aligned}$$

In fact the regressions are a joint test of the model and the appropriateness of the proxies selected. For instance, a positive intercept b_0 would suggest that nonoperating assets or operating cash flows have been consistently underestimated or change in firm value has been consistently overestimated. Ignoring debt causes both nonoperating assets and operating cash flows to be overstated, which could cause either b_0 to be negative or b_1 or b_2 to be less than predicted.

The proxies and predictions are summarized in table C.11. The regression coefficient for nonoperating assets b_1 is predicted to be positive and approximately equal to the discount rate. The regression coefficient for operating cash flow b_2 is predicted to be positive. It may be less than +1 if ignoring debt and taxes is important. The regression coefficient for dividend change b_3 is predicted to be positive and greater than 1.

The sample

This chapter uses the 1981-87 quarterly data on the 270 firms in the sample described in chapter 2 of the dissertation.

Statistical procedures

The statistical procedures are the same as for the tests in the previous sections of this paper.

Results

Table C.12 shows the mean and the quartiles of the variables used in the regression. The mean cum dividend return for the firms in the sample was 4.78% per quarter, or about 19% annually. The median return of 4.57% is similar. Cash and investments represented 48.1% of firm value at the mean, though the median amount is only 7.4%. The variable is highly skewed to the left as the mean is larger than the third quartile. Operating cash flow for the quarter is two to three percent of firm value on average, though for more than 25% of the firms it is negative. Note also that data on operating cash flow is available for less than half the firm quarters. In more than half the firm quarters there is no change in dividends; the mean change is only .015% of firm value. Table C.13 indicates that the statistics are similar when returns are measured over months two to four rather than over months one to three (the quarter itself), and the variables are scaled by market value at the beginning of month two rather than the beginning of month one (i.e. the beginning of the quarter).

The first two rows of table C.14 show the results of regressing equation C.1 on the 3571 firm quarters with data on operating cash flow. The regression R^2 is less than 1% and White's χ^2 statistic indicates that the regression is misspecified; thus the results should be treated with caution. The intercept term is significantly positive contrary to prediction. The coefficient on cash and investments is significantly positive and less than one as predicted; its value of four percent seems reasonable as representing the quarterly rate of return. The regression coefficient on the proxy for operating cash flow is significantly positive as predicted, but is significantly less than one, contrary to prediction. The coefficient on the change in dividends is significantly greater than one as predicted.

The next four rows report the average results of the time series regressions of the equation. The mean intercept term for the 154 firms with at least five quarters of data is -0.018, which is significantly less than zero at the 10% level contrary to prediction. The median intercept obtained of -0.013 has a similar level of significance. The following four rows provide the same information for regressions in which the time series residual was assumed to be autoregressive. The average regression coefficient on cash and investments for both types of regressions is significantly positive, but both the median and mean results are much higher than the model would predict. The average coefficient on the proxy for operating cash flows is significantly positive and is larger than that obtained in the pooled regression, but is still much smaller than one. The median estimates for the effect of the change in dividends are zero, but the mean is negative, though not significantly so. This result may have been obtained because so many of the observations for change in dividend are zero.

The last four rows report the average result of the cross sectional regressions of the equation. The mean intercept term for the 28 quarters is .038, which is significantly positive at the 10% level contrary to prediction. The average coefficient on cash and investments is not significant at conventional significance levels, contrary to prediction. The regression coefficient on operating cash flow is significantly positive, but is even smaller than that obtained in the pooled regression. The average coefficients on change in dividends are significantly greater than one as predicted.

Table C.15 reports the results of the same regressions in which the intercept was constrained to be zero. The constraint increased the regression coefficients on cash and investments so that they are significantly positive at at least the 10% level in all cases; but the estimates so obtained are much larger than the model would predict. The constraint did not have much effect on the coefficients on operating cash flow: they remain significantly positive, but much smaller than one. The constraint increased the magnitude of the coefficients obtained on change in dividends: the results for the pooled and cross sectional regressions are again significantly greater than one as predicted, while the time series means are negative and nearly significantly so.

Some of the coefficients on the change in dividends obtained in the time series regressions are much higher in magnitude than the rest. The five largest and the five smallest results for each of the four regressions in the two tables were examined.

Three of the five largest and three of the five smallest were obtained from the same six firms. The regressions were run again dropping the six firms; the results are reported in tables C.16 and C.17. The results are similar to that obtained when the six firms were included, except for the case when the intercept is not constrained and the residual term is assumed to be autoregressive. Here dropping the six firms produces an insignificantly positive mean regression coefficient of 1.439 on the change in dividends, rather than the coefficient of -9.293 obtained when the six firms were included in the mean. Note that the mean coefficient on operating cash flow is negative in this case, though the median remains significantly positive.

Tables C.18 and C.19 report results from the same regressions when returns are measured over months two to four. The pooled results are similar except that the coefficient on operating cash flow is insignificantly negative when the intercept is not constrained. The time series regression coefficients on cash and investments continue to be significantly positive, but larger than the model would predict. The time series regression coefficients on operating cash flow continue to be much less than one; indeed the means become negative when the intercept is constrained to be zero, though the medians remain significantly positive. The effect of the change in returns measurement period on the average regression coefficients of the change in dividends is more interesting. When the intercept is unconstrained, the average coefficients are between plus and minus one. When the intercept is constrained to be zero, the medians are significantly positive and greater than one, and the means are much greater than one, though barely significant. The average cross sectional regression coefficients are not much affected by changing the period over which returns are cumulated, except that the median regression coefficient on operating cash flow is negative when the intercept is constrained to be zero.

In summary, the sample provides strong evidence that cash and investments are positively associated with firm value, but the regression coefficients approximate the predicted magnitude of the discount rate only when all the observations are pooled; the average time series coefficients appear too large, and the average cross sectional coefficients too small. The sample also provides evidence that operating cash flow is positively associated with firm value, but the magnitudes obtained are much smaller than the predicted level of one. The sample evidence weakly supports the prediction that a change in dividends has a multiplier effect on firm value. The regression coefficients obtained in the pooled and cross sectional regressions are all significantly greater than one as predicted, but the time series regression coefficients are generally insignificant and commonly of the opposite sign to that predicted.

C.3.3 Summary of empirical evidence using quarterly and annual data

Comparing the dividend response coefficients in tables C.14 and 3.18 indicates that using annual data produces significantly positive coefficients as predicted for the time series regressions while using quarterly data produces insignificantly negative coefficients. On the other hand, the pooled and cross sectional quarterly response coefficients are significantly positive as predicted, while the annual pooled and cross-sectional regressions produce insignificantly positive response coefficients. On the other hand, using the later time period to compute returns (months 2 to 4 for quarterly data and months 3 to 14 for annual data) produces significantly positive dividend response coefficients for the quarterly data but insignificant and sometimes negative response coefficients for the annual data.

The coefficients on operating cash flow are significantly positive, except for some of the regression using returns over months 2 to 4, but are significantly less than one, contrary to prediction, except for the annual time series regressions which include the intercept. The coefficients on cash and investments are significantly positive as predicted, except in the pooled annual returns and the cross sectional regressions which include the intercept, but are much larger than the discount rate in the time series regressions.

C.4 Tests of hypotheses H7 to H9

This section discusses tests of hypotheses H7, H8, and H9 additional to those reported in section 3.5.5. It also examines a variant of hypothesis H8. That hypothesis predicted that the dividend response coefficient should decrease as the discount rate increased. The discount rate varies across firms with variations in their systematic risk. The discount rate also varies through time as the risk free rate varies. The ten year constant maturity market yield on government securities obtained from the S & P Statistical Services (1990) was used to represent the interest rate.

The tests also examine the effect of using the operating cash flow growth rate, estimated by regressing the log of operating cash flow on the calendar year, to proxy for growth rather than using the dividend growth rate.

The first two sections report univariate and additional multivariate tests of the variation in the dividend response coefficient using the same data as in table 3.20. The following section repeats the tests using the quarterly response coefficients obtained in section C.3.2.

C.4.1 Univariate tests using annual returns

Table C.20 reports the results of the univariate test of the associations between the dividend response coefficients and firm payout, discount, and growth rates. The first numeric column reports the level of significance of the comparison between the mean response coefficient in the bottom quartile of firm payout rates to the mean response coefficient in the top quartile of payout rates. The comparison is significant and in the direction predicted by hypothesis H7 in all cases, except possibly when the response coefficient was determined in the regression which used month 1 to 12 returns and no intercept. The average rank of the dividend response coefficient for firms whose payout rate was in the lowest quartile was significantly higher than the average rank of the dividend response coefficient of firms whose payout rate was in the highest quartile, when the response coefficient was computed using returns calculated over months 3 to 14. The comparison was less significant when the response coefficient was computed using the returns over months 1 to 12.

Numerical columns 3 and 4 of table C.20 indicated that higher dividend growth rates are associated with higher dividend response coefficients, as predicted by hypothesis H9. Higher ranking dividend response coefficients are found in the top operating cash flow growth rate quartile than in the bottom quartile, but the relation is generally not significant when the response coefficients are determined by regressing the month 1 to 12 returns on the equation with an intercept. Indeed in this case, the mean dividend response coefficients are higher in the lower growth rate quartile, contrary to hypothesis H9.

Higher dividend response coefficients are generally found in the lower beta quartiles as predicted in hypothesis H8, but the relations is significant in less than half the tests.

C.4.2 Multivariate regression tests using annual returns

Table C.21 provides the results of regressing the dividend response coefficients obtained in the time series regressions (rows 4 to 15) of tables 3.18 and 3.19 on the payout rate, beta, and the dividend growth rate. For each set of response coefficients, the regressions were run first using all 249 observations, second using the observation with positive response coefficients and rates, and third using the logarithms of the variables. The regression coefficient on the dividend payout rate is negative as predicted in hypothesis H7, and almost always significantly so. The regression coefficient on firm betas is insignificant, contrary to hypothesis H8. The regression coefficient on the dividend growth rate is significantly positive as predicted (hypothesis H9) when all 249 observations are used, but is insignificant when the subsets of the observations are used.

Table C.22 reports the results of repeating the regressions substituting the growth in observed operating cash flow for the dividend growth rate as the proxy for the growth in persistent operating cash flow. As in the preceding table, the coefficient on firm dividend payout rates is almost always significantly negative as predicted by hypothesis H7, while the coefficient on firm beta is insignificant contrary to hypothesis H8. Unlike the previous regression, the coefficient on the growth rate in operating cash flow is negative, contrary to hypothesis H9, and is often significantly negative.

Tables C.23 and C.24 report the results of repeating the regressions using the dividend response coefficients calculated in the time series regressions reported in tables C.9 and C.10. Although the average dividend response coefficients reported in the latter tables were negative, contrary to prediction, the results of using those response coefficients as the dependent variables in the regressions reported in the former tables generally provide stronger support than the results discussed in the previous paragraphs. Using the dividend growth rate to proxy for the growth in persistent operating cash flow produces significantly positive regression coefficients even when the logarithm transformation is used. Using the operating cash flow growth rate does still produce negative regression coefficients in most cases, but they are no longer significant so. The regression coefficients on firm beta are now significantly negative as predicted when all 249 response coefficients are used. The response coefficients on the dividend payout rates continue to be significantly negative as predicted.

In summary, the regressions provide strong support for the prediction (hypothesis

H7) that the dividend response coefficient is inversely related to the payout rate. Some support is provided for the predictions (hypotheses H8 and H9) that the response coefficient is inversely related to beta and related to the growth rate, but the support is not consistent across proxies and methods of calculating the response coefficient.

C.4.3 Tests using 1981-87 quarterly data on 270 firms

This section examines empirically the relation between the dividend response coefficients obtained in the regressions reported in section C.3.2 and the dividend payout rate, the discount rate, and the growth rate. Chapter 1 of the dissertation predicts that the relation will be of the following form:

$$\begin{aligned} DRC &= \frac{gd^{-1} - gT}{r - g}, \\ \log DRC &= \log g + \log[d^{-1} - T] - \log[r - g]. \end{aligned}$$

Table C.25 reports the results of regressing the dividend response coefficient on the proxies for the dividend payout rate, firm beta, and the dividend growth rate. The first two rows of the table report the result for the dividend response coefficients obtained for each of the 154 firms from the regressions whose averages are reported in rows three through six of table C.14. The regression R^2 is zero and the coefficients are generally insignificant except for that on beta. Using only the 69 firms with positive dividend response coefficients produces somewhat better R^2 and significance level. Transforming the regression variables by taking their logarithms produces a significantly positive coefficient for the dividend growth rate as predicted.

The dividend response coefficients used in rows seven to twelve of the table were obtained from the 154 firms whose average regression results are reported in rows seven to ten of table C.14. The results are similar to those discussed above except that the regression coefficient on beta is significantly negative at the 10% level as predicted except when the log transformation is performed.

The dividend response coefficient in rows 13 to 18 and rows 19 to 24 of the table were obtained from the firms whose average regression results are reported in rows three to six and seven to ten of table C.15. The regression coefficients obtained are generally of the predicted sign, but significantly so only half the time.

Table C.26 reports the results of the same regression when the dividend response coefficients were obtained from the same firms except the six outliers discussed above.

The regression coefficients on the dividend payout rate are similar to those in the previous table. The regression coefficients on beta vary greatly: the untransformed results from the regression with autoregressive residual terms are significantly negative as predicted, the log transforms are all positive and those based on the regressions with intercept constrained to zero are significantly so, the remaining coefficients are not significantly different from zero. The regression coefficients on the dividend growth rate are positive as predicted, with over half being significantly so.

Table C.27 reports the results when the regressions use the dividend response coefficients whose averages are reported in tables C.18 and C.19. The coefficients on the dividend payout rate are generally negative as predicted, but none are significantly so. The regression coefficients on beta are significant negative as predicted when all the firms with data are used, but are positive, and sometime significantly so when only the firms with positive DRCs are used. The regression coefficients on the dividend growth rate are all positive as predicted, and almost all are significantly so.

Table C.28 provides the results of additional tests of the empirical evidence on the variation in dividend response coefficients. The first two numerical columns report the results of comparing the dividend response coefficients for the firms with the largest payout rates to those with the smallest. The first column compares the means of the top and bottom payout rate quartiles, the second column compares the mean ranks of the top and bottom payout rate quartiles. The first comparison is not significant, but the mean rank of the DRCs of the firms in the top payout rate quartile is significantly lower than that of the firms in the bottom payout rate quartile when the DRCs were computed in the regression reported in tables C.14 and C.15.

The second pair of numerical columns report the test results for the comparison of the DRCs of firms in the top dividend growth rate quartile to those in the bottom dividend growth rate quartile. The DRCs are almost all significantly greater for firms in the top quartile compared to those in the bottom quartile.

The third pair of numerical columns reports that the mean DRCs of the firms in the top beta quartile are lower than those in the bottom quartile, and generally significantly so. The mean ranks are generally as predicted, but only significantly so for the case when returns are measured over months two to four and the regressions intercept is constrained to zero.

The last two columns report the results for the time series variation in interest rates. The DRCs for the 7 quarters with the highest interest rates are lower than for the 7 quarters with the lowest interest rates, and generally significantly so.

The first six rows of table C.29 report the results of regressing the quarterly dividend response coefficients whose mean and median are reported in the last four rows of table C.14 on the quarter's interest rate. The regression coefficients are significantly negative as predicted. Similar results are reported in the last six rows for the DRCs whose averages are reported in the last four rows of table C.15, and in table C.30 for the DRCs whose averages are reported in the last rows of table C.18 and C.19.

In summary, the various tests indicate almost without exception that higher dividend payout rates are associated with lower dividend response coefficients, but only some of the tests are individually significant. A comparison of dividend response coefficients in the top beta quartile to those in the bottom beta quartile provides significant support for the prediction that higher betas are associated with lower dividend response coefficients, but the regression results are mixed. All the tests support the predictions that higher growth rates are associated with higher dividend response coefficients and that higher interest rates are associated with lower dividend response coefficients, and the majority of the individual tests are significant.

C.4.4 Summary of empirical evidence using quarterly and annual data

The evidence on the predicted cross-sectional variation in the dividend response coefficients is stronger using the annual data than using the quarterly data. The evidence strongly supports hypotheses H7 and H9, but the evidence with regard to the relation between the dividend response coefficient and beta is mixed. Using the quarterly data produces a significantly negative relation between interest rates and dividend response coefficients as predicted by the model in chapter 1.

Table C.1: Constructs, proxies, and predicted coefficients for tests of hypothesis H1 on the relation between nonoperating assets, operating cash flow, dividends, and firm value

Model		Test	
Construct[1]	Coefficient	Proxy[2]	Coefficient
Firm value		Common stock value	
Nonoperating assets	+1	Cash and short term investments	+1
Present value of operating cash flow	+1	Operating income summed over 5 years	+
Present value of dividend tax cost	-1	Dividends summed over 5 years	-
Dividend payout rate	α_1	Dividends / operating income	+
Dividend payout rate squared	α_2	Dividends / operating income squared	-

Notes:

[1] All measured at the beginning of the period.

[2] All scaled by number of common shares.

Table C.2: Data selection criteria for tests of the relation between nonoperating assets, operating cash flow, dividends, and firm value

Less	Total	
	3780	Firms on CRSP (monthly returns file)
869	3079	with price and return data preceding April 1984
1974	1105	and following January 1989
85	1020	and on the Compustat industrial company quarterly file (of 7028 firms on Compustat, 6008 are not on CRSP with full price and returns data)
8	1012	and with some earnings announcements for 1984 to 1988
51	961	and with earnings announcements for 4th quarter 1988
168	793	and with March June September or December yearend
12	781	and with no change in yearend during the period
27	754	and with a earnings announcement for first quarter 1984
130	624	and with a full set of earnings announcements for 1984 to 1988
5	619	and on the CRSP monthly distributions file
35	584	and with some dividend declarations for 1984 to 1988
67	517	and with a dividend announcement for last quarter 1988
364	153	which are regular quarterly (1232) dividends
15	138	and with a full set of dividend announcements for 1984 to 1988
82	56	and with operating income for each quarter.

Table C.3: Correlation matrix for variables in tests of the relation between nonoperating assets, operating cash flow, dividends, and firm value

CORR	PRICE1	DIVSUM	FUNDS	NISUM	IBXISUM	VARIABLE LABEL
PRICE1	1.0000	0.2546	0.7542	0.7735	0.7369	30 March 1984 price
DIVSUM	0.2546	1.0000	-0.0424	0.2426	0.3384	Dividends summed over 5 years
FUNDS	0.7542	-0.0424	1.0000	0.8189	0.7637	Cash and short term investments per share
NISUM	0.7735	0.2426	0.8189	1.0000	0.9828	Net income summed over 5 years
IBXISUM	0.7369	0.3384	0.7637	0.9828	1.0000	Income before extraordinary items summed
OPSUM	0.8017	0.4865	0.6529	0.7797	0.7968	Operating income before depr summed
OPLDSUM	0.8374	0.3709	0.7386	0.8643	0.8637	Operating income less depreciation summed
PRICELG1	0.9754	0.1953	0.7428	0.7632	0.7278	31 December 1983 price
FUNDS1	0.6309	0.0468	0.7184	0.5435	0.4915	31 December 1983 funds per share
DIVNI	-0.0200	0.1709	-0.2124	-0.3911	-0.4142	Payout ratio: dividends / net income
DIVIB	-0.0013	0.1579	-0.1549	-0.2895	-0.3296	Payout ratio
DIVOPLD	-0.1580	0.0176	-0.1554	-0.2781	-0.2987	Payout ratio
DIVOP	-0.1733	0.1392	-0.1771	-0.2510	-0.2585	Payout ratio: dividends / operating income

CORR	OPSUM	OPLDSUM	PRICELG1	FUNDS1	DIVNI	
PRICE1	0.8017	0.8374	0.9754	0.6309	-0.0200	30 March 1984 price
DIVSUM	0.4865	0.3709	0.1953	0.0468	0.1709	Dividends summed over 5 years
FUNDS	0.6529	0.7386	0.7428	0.7184	-0.2124	Cash and short term investments per share
NISUM	0.7797	0.8643	0.7632	0.5435	-0.3911	Net income summed over 5 years
IBXISUM	0.7968	0.8637	0.7278	0.4915	-0.4142	Income before extraordinary items summed
OPSUM	1.0000	0.9643	0.7574	0.4545	-0.1423	Operating income before depr summed
OPLDSUM	0.9643	1.0000	0.8078	0.5098	-0.1988	Operating income less depreciation summed
PRICELG1	0.7574	0.8078	1.0000	0.6564	-0.0451	31 December 1983 price
FUNDS1	0.4545	0.5098	0.6564	1.0000	0.0304	31 December 1983 funds per share
DIVNI	-0.1423	-0.1988	-0.0451	0.0304	1.0000	Payout ratio: dividends / net income
DIVIB	-0.1131	-0.1442	-0.0240	0.0714	0.9303	Payout ratio
DIVOPLD	-0.3331	-0.3455	-0.1753	-0.0203	0.4907	Payout ratio
DIVOP	-0.3595	-0.3387	-0.1802	0.0236	0.4691	Payout ratio: dividends / operating income

CORR	DIVIB	DIVOPLD	DIVOP	
PRICE1	-0.0013	-0.1580	-0.1733	30 March 1984 price
DIVSUM	0.1579	0.0176	0.1392	Dividends summed over 5 years
FUNDS	-0.1549	-0.1554	-0.1771	Cash and short term investments per share
NISUM	-0.2895	-0.2781	-0.2510	Net income summed over 5 years
IBXISUM	-0.3296	-0.2987	-0.2585	Income before extraordinary items summed
OPSUM	-0.1131	-0.3331	-0.3595	Operating income before depr summed
OPLDSUM	-0.1442	-0.3455	-0.3387	Operating income less depreciation summed
PRICELG1	-0.0240	-0.1753	-0.1802	31 December 1983 price
FUNDS1	0.0714	-0.0203	0.0236	31 December 1983 funds per share
DIVNI	0.9303	0.4907	0.4691	Payout ratio: dividends / net income
DIVIB	1.0000	0.3263	0.3516	Payout ratio
DIVOPLD	0.3263	1.0000	0.8744	Payout ratio
DIVOP	0.3516	0.8744	1.0000	Payout ratio: dividends / operating income

Table C.4: Descriptive statistics for variables in tests of the relation between nonoperating assets, operating cash flow, dividends, and firm value

Variables	Mean	Variance	Std Deviation	Variable label
PRICE1	32.68	362.97	19.05	30 March 1984 price
DIVSUM	6.55	19.30	4.39	Dividends summed over 5 years
FUNDS	4.64	76.23	8.73	Cash and short term investments per share
NISUM	14.23	181.07	13.46	Net income summed over 5 years
IBXISUM	14.08	137.89	11.74	Income before extraordinary items summed
OPSUM	48.87	1300.76	36.07	Operating income before depr summed
OPLDSUM	31.09	696.30	26.39	Operating income less depreciation summed
PRICELG1	35.47	390.28	19.76	31 December 1983 price
FUNDS1	3.76	13.84	3.72	31 December 1983 funds per share
DIVNI	0.71	0.47	0.69	Payout ratio: dividends / net income
DIVIB	0.77	1.24	1.12	Payout ratio:
DIVOPLD	0.30	0.09	0.31	Payout ratio
DIVOP	0.16	0.01	0.12	Payout ratio: dividends / operating income

Table C.5: Parameter estimates from regressing March 31 1984 price on selected variables

Panel A

$$V_t = C_t + E_t\{\sum_{j=t+1}^{\infty} r^{t-j}Y_j\} - E_t\{\sum_{j=t+1}^{\infty} r^{t-j}D_jT_j\}$$

Number of Observations	R-square	Adjusted R-square
56	0.7418	0.7269

Variable	Prediction	Parameter Estimate	Standard Error	T for H0: Parameter= 0	Prob > T	Variable Label
INTERCEP	0	11.10	2.77	4.007	0.0001	Intercept
FUNDS1	+1	1.73	0.38	4.590	0.0001	31 December 1983 funds per share
OPSUM	+	0.36	0.048	7.613	0.0001	Operating income before depr summed
DIVSUM	–	-0.38	0.36	-1.074	0.1439	Dividends summed over 5 years

Panel B

$$V_t = C_t + E_t\{\sum_{j=t+1}^{\infty} r^{t-j}Y_j\} - E_t\{\sum_{j=t+1}^{\infty} r^{t-j}D_jT_j\} + \alpha_1 d - \alpha_2 d^2$$

Number of Observations	R-square	Adjusted R-square
56	0.7891	0.7680

Variable	Prediction	Parameter Estimate	Standard Error	T for H0: Parameter= 0	Prob > T	Variable Label
INTERCEP	0	-4.32	5.27	-0.819	0.4164	Intercept
FUNDS1	+1	1.23	0.38	3.222	0.0011	31 December 1983 funds per share
OPSUM	+	0.53	0.067	7.893	0.0001	Operating income before depr summed
DIVSUM	–	-1.61	0.49	-3.268	0.0010	Dividends summed over 5 years
DIVOP	+	138.43	42.35	3.268	0.0010	Payout ratio: dividends / operating income
DIVOP2	–	-139.89	48.44	-2.887	0.0029	Payout ratio squared

Table C.6: Tests of hypotheses H3 to H5: probability that DRC in first and fourth quartiles are equal

Quartiles of	No intercept[1]		With intercept[2]	
	t test	Wilcoxon test	t test	Wilcoxon test
Dividend payout rate	.0608	.0050	.0050	.0458
Discount rate (risk)	-.0018	-.0008	.0227	.0318
Growth rate (dividend)	.3139	.0001	.0127	.0001
Growth rate (op. cash flow)	.1699	.2613	.3388	.0129

Notes:

Negative numbers indicate inequality is in opposite direction to that hypothesized.

[1] Intercept set to zero in estimation of DRC.

[2] Intercept unconstrained in estimation of DRC.

Table C.7: Evidence on the cross-sectional variation in the dividend response coefficient, when the coefficient estimated by regressing firm value on dividends

$$\begin{aligned} \text{Dividend response coefficient} &= b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} \\ &+ b_3 * \text{Dividend growth rate} \\ &+ b_4 * \text{Operating cash flow growth rate} \end{aligned}$$

Case Prediction	b_0	b_1 –	b_2 –	b_3 +	b_4 +	Adjusted R^2
No, yes	4.02	-0.09	1.08	0.31		.207
	.000	.316	.998	.032		
No, yes	3.37	-0.19	1.31		0.11	.176
	.000	.177	.999		.126	
No, no	13.81	-16.77	17.11	80.99		.140
	.172	.070	.946	.019		
No, no	3.05	-17.68	27.59		56.42	.157
	.775	.059	.997		.010	
Yes, yes	3.27	-0.33	-0.32	-0.03		.000
	.000	.128	.273	.552		
Yes, yes	3.42	-0.34	-0.32		0.03	.000
	.000	.124	.266		.414	
Yes, no	90.24	-28.29	-11.83	-83.28		.000
	.001	.174	.337	.791		
Yes, no	88.14	-31.39	-19.65		19.40	.000
	.003	.151	.228		.381	

Notes:
See table 3.6 for proxy definitions
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t test except for the intercept which is two tail.)
The cases are:
No, yes : No intercept in estimation of DRC, above regression done using logarithm of all variables
No, no: No intercept in estimation of DRC, above regression done using variables as stated
Yes, yes: Intercept used in estimation of DRC, above regression done using logarithm of all variables
Yes, no: Intercept used in estimation of DRC, above regression done using variables as stated

Table C.8: Descriptive statistics for cash flow from operating and nonoperating activities, the change in dividends, and the change in firm value, when association period is months 3 to 14

	Mean	St D	Q1	Q2	Q3	Obs
Month 3 to 14 returns	0.197	0.322	-0.020	0.164	0.367	1743
Cash and investments[1]	0.194	0.204	0.069	0.126	0.256	1743
Operating cash flow[1]	0.130	0.166	0.054	0.114	0.192	1743
Change in dividends[1]	0.00086	0.150	0	0.0018	0.0037	1743

Notes:

Table provides the predicted value, the mean, the standard deviation, the first, second, and third quartiles, and the number of observations, and the reference for each variable.

[1] Scaled by market value of the firm's common stock at the beginning of March.

Table C.9: Tests of hypothesis H6: evidence on the relation between cash flow from operating and nonoperating activities, the change in dividends, and the change in firm value, when association period is months 3 to 14

$$\text{Returns} = b_0 + b_1 * \text{Cash and investments} + b_2 * \text{Operating cash flow} + b_3 * \text{Change in dividends}$$

Case	b_0	b_1	b_2	b_3
Predicted	0	+	1	+
Pooled[1]	0.142	0.019	0.391	-0.054
	.000	.306	.000	.859
		.000	.000	.000
Mean t.s.[2]	-0.196	2.448	1.161	-11.659
	.000	.000	.000	.863
		.001	.521	.232
Median t.s.[3]	-0.094	0.913	0.720	-1.384
	.000	.000	.000	.800
		.033	.378	.273
Mean t.s.a.[4]	-0.144	2.127	1.067	-12.633
	.001	.000	.000	.876
		.008	.790	.213
Median t.s.a.[5]	-0.056	0.793	0.686	-1.072
	.007	.000	.000	.826
		.303	.161	.246
Mean c.s.[6]	0.159	-0.044	0.336	0.579
	.090	.791	.001	.132
		.000	.000	.404
Median c.s.[7]	0.181	-0.081	0.379	0.076
	.156	.852	.008	.234
		.016	.016	.375

Notes:
The second row of each set of rows gives the (one tail) probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (Except for the intercept which is two tail.) The third row of each set of rows gives the (two tail) probability of observing the regression coefficient above, given the null hypothesis that the coefficient is one.
Tests of means and pooled regressions are t tests; tests of medians are nonparametric sign tests.
See table 3.4 for proxy definitions.
[1] 1743 observations.
Adjusted R^2 = .0401, White's χ^2 statistic = .0389, Largest variance inflation factor = 1.003.
[2] Mean of 249 time series regressions of 7 observations each.
[3] Median of 249 time series regressions of 7 observations each.
[4] Mean of 249 time series regressions of 7 observations each, assuming first order autoregression in the residual term
[5] Median of 249 time series regressions of 7 observations each, assuming first order autoregression in the residual term
[6] Mean of 7 cross sectional regressions of 249 observations each.
[7] Median of 7 cross sectional regressions of 249 observations each.

Table C.10: Tests of hypothesis H6: evidence on the relation between cash flow from operating and nonoperating activities, the change in dividends, and the change in firm value, when intercept set to 0 and the association period is months 3 to 14

$$\text{Returns} = b_1 * \text{Cash and investments} + b_2 * \text{Operating cash flow} + b_3 * \text{Change in dividends}$$

Case	b_1	b_2	b_3
Predicted	+	1	+
Pooled[1]	0.280	0.653	-0.036
	.000	.000	.750
	.000	.000	.000
Mean t.s.[2]	1.496	0.638	-21.083
	.000	.000	.992
	.127	.028	.011
Median t.s.[3]	0.582	0.614	-3.426
	.000	.000	.992
	.223	.004	.008
Mean t.s.a.[4]	1.354	0.714	-17.001
	.000	.000	.972
	.244	.100	.043
Median t.s.a.[5]	0.534	0.610	-1.137
	.000	.000	.948
	.122	.010	.060
Mean c.s.[6]	0.240	0.613	0.719
	.046	.002	.146
	.001	.034	.668
Median c.s.[7]	0.279	0.679	0.068
	.078	.008	.234
	.016	.078	.375

Notes:
The second row of each set of rows gives the (one tail) probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (Except for the intercept which is two tail.) The third row of each set of rows gives the (two tail) probability of observing the regression coefficient above, given the null hypothesis that the coefficient is one.
Tests of means and pooled regressions are t tests; tests of medians are nonparametric sign tests.
See table 3.4 for proxy definitions.
[1] 1743 observations.
White's χ^2 statistic = .0454, Largest variance inflation factor = 1.000.
[2] Mean of 249 time series regressions of 7 observations each.
[3] Median of 249 time series regressions of 7 observations each.
[4] Mean of 249 time series regressions of 7 observations each, assuming first order autoregression in the residual term
[5] Median of 249 time series regressions of 7 observations each, assuming first order autoregression in the residual term
[6] Mean of 7 cross sectional regressions of 249 observations each.
[7] Median of 7 cross sectional regressions of 249 observations each.

Table C.11: Constructs, proxies, and predicted coefficients for tests of the relation between nonoperating assets, cash flow from operations, the change in dividends, and the change in firm value

Model		Test	
Construct	Coefficient	Proxy[2]	Coefficient
Change in firm value		Change in common stock price during quarter t	
Nonoperating assets	$r-1$	Cash and short term investments, end of quarter t–1	+
Operating cash flow	+1	Operating cash flow during quarter t	+1
Change in dividends	> 0	Dividends declared, week 10 of quarter t to week 9 of quarter t+1 – dividends declared, week 10 of quarter t–1 to week 9 of quarter t	+

Proxies defined in term of Compustat definitions and item numbers

Cash and investments equals		
	D36	Cash and short-term investments
Operating cash flow equals		
+	D21	Operating income before depreciation
–	D90[3]	Capital expenditures
+	D83[3]	Proceeds of sale of property, plant, and equipment
+		Decrease in non-cash working capital
Non-cash working capital equals		
+	D40	Current assets
–	D36	Cash and short-term investments
–	D46	Accounts payable
–	D48	Current liabilities – other (than debt in current liabilities and income taxes payable)

Notes:
[2] All proxies are scaled by number of common shares used to calculate primary earnings per share times the common share price at the beginning of the period.
[3] If no data available on Compustat, then amount assumed to be zero.

Table C.12: Descriptive statistics for cash flow from operating and nonoperating activities, the change in dividends, and the change in firm value, when association period is the quarter

	Mean	St D	Q1	Q2	Q3	Obs
Month 1 to 3 returns	0.0478	0.146	-0.0452	0.0457	0.1364	7532
Cash and investments	0.481	1.452	0.033	0.074	0.170	5941
Operating cash flow	0.0266	0.1064	-0.0135	0.0228	0.0680	3571
Change in dividends	0.000147	0.000809	0.000	0.000	0.000	7532

Notes:
Table provides the predicted value, the mean, the standard deviation, the first, second, and third quartiles, and the number of observations, and the reference for each variable.

Table C.13: Descriptive statistics for cash flow from operating and nonoperating activities, the change in dividends, and the change in firm value, when association period is months 2 to 4

	Mean	St D	Q1	Q2	Q3	Obs
Month 2 to 4 returns	0.0498	0.146	-0.0384	0.0469	0.1334	7532
Cash and investments	0.476	1.430	0.033	0.073	0.169	5941
Operating cash flow	0.0253	0.1067	-0.0137	0.0229	0.0674	3571
Change in dividends	0.000144	0.000828	0.000	0.000	0.000	7532

Notes:
Table provides the predicted value, the mean, the standard deviation, the first, second, and third quartiles, and the number of observations, for each variable.

Table C.14: Tests of hypothesis H6: evidence on the relation between cash flow from operating and nonoperating activities, the change in dividends, and the change in firm value when the association period is months 1 to 3 (the quarter itself)

$$\begin{aligned}\text{Returns} &= b_0 + b_1 * \text{Cash and investments} + b_2 * \text{Operating cash flow} \\ &+ b_3 * \text{Change in dividends}\end{aligned}$$

Case	b_0	b_1	b_2	b_3
Predicted	0	+	1	+
Pooled[1]	0.037	0.041	0.106	6.316
	.000	.026	.000	.026
Mean t.s.[2]	-0.018	0.754	0.347	-8.099
	.072	.000	.000	.716
Median t.s.[3]	-0.013	0.417	0.238	0.000
	.082	.000	.000	
Mean t.s.a.[4]	-0.023	0.811	0.361	-9.293
	.030	.000	.000	.744
Median t.s.a.[5]	-0.014	0.458	0.223	0.000
	.048	.000	.000	
Mean c.s.[6]	0.038	0.016	0.079	12.974
	.083	.259	.032	.021
Median c.s.[7]	0.046	0.012	0.072	7.114
	.048	.224	.026	.008

Notes:
See table C.11 for proxy definitions.
[1] 3571 observations.
Adjusted $R^2 = .0068$, White's χ^2 statistic = .0103, Largest variance inflation factor = 1.004.
[2] Mean of 154 time series regressions of up to 28 observations each.
[3] Median of 154 time series regressions of up to 28 observations each.
[4] Mean of 154 time series regressions of up to 28 observations each, assuming first order autoregression in the residual term
[5] Median of 154 time series regressions of up to 28 observations each, assuming first order autoregression in the residual term
[6] Mean of 28 cross sectional regressions of up to 270 observations each.
[7] Median of 28 cross sectional regressions of up to 270 observations each.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. Tests of means and pooled regressions are t tests; tests of medians are nonparametric sign tests. (One tail tests except for the intercept which is two tail.)

Table C.15: Evidence on the relation between cash flow from operating and nonoperating activities, the change in dividends, and the change in firm value, when intercept set to 0 and the association period is months 1 to 3 (the quarter itself)

$$\begin{aligned} \text{Returns} &= b_1 * \text{Cash and investments} + b_2 * \text{Operating cash flow} \\ &+ b_3 * \text{Change in dividends} \end{aligned}$$

Case	b_1	b_2	b_3
Predicted	+	1	+
Pooled[1]	0.180	0.147	8.999
	.000	.000	.003
Mean t.s.[2]	0.906	0.279	-14.477
	.000	.002	.851
Median t.s.[3]	0.508	0.196	0.000
	.000	.000	
Mean t.s.a.[4]	0.896	0.301	-16.811
	.000	.001	.877
Median t.s.a.[5]	0.477	0.211	0.000
	.000	.000	
Mean c.s.[6]	0.153	0.116	20.871
	.010	.049	.067
Median c.s.[7]	0.138	0.067	12.876
	.003	.059	.021

Notes:
See table C.11 for proxy definitions.
[1] 3571 observations.
White's χ^2 statistic = .0142, Largest variance inflation factor = 1.000.
[2] Mean of 160 time series regressions of up to 28 observations each.
[3] Median of 160 time series regressions of up to 28 observations each.
[4] Mean of 159 time series regressions of up to 28 observations each, assuming first order autoregression in the residual term
[5] Median of 159 time series regressions of up to 28 observations each, assuming first order autoregression in the residual term
[6] Mean of 28 cross sectional regressions of up to 270 observations each.
[7] Median of 28 cross sectional regressions of up to 270 observations each.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. Tests of means and pooled regressions are t tests; tests of medians are nonparametric sign tests. (One tail tests except for the intercept which is two tail.)

Table C.16: Evidence on the relation between cash flow from operating and nonoperating activities, the change in dividends, and the change in firm value when the association period is months 1 to 3 (the quarter itself) after eliminating 6 outliers

$$\begin{aligned} \text{Returns} &= b_0 + b_1 * \text{Cash and investments} + b_2 * \text{Operating cash flow} \\ &+ b_3 * \text{Change in dividends} \end{aligned}$$

Case	b_0	b_1	b_2	b_3
Predicted	0	+	1	+
Pooled[1]	0.037	0.042	0.106	5.954
	.000	.022	.000	.032
Mean t.s.[2]	-0.016	0.730	0.307	-7.656
	.073	.000	.000	.834
Median t.s.[3]	-0.011	0.374	0.244	0.000
	.091	.000	.000	
Mean t.s.a.[4]	-0.013	0.504	-0.290	1.439
	.636	.208	.740	.478
Median t.s.a.[5]	-0.013	0.430	0.204	0.000
	.141	.000	.000	

Notes:
See table C.11 for proxy definitions.
[1] 3475 observations.
Adjusted $R^2 = .0064$, White's χ^2 statistic = .0080, Largest variance inflation factor = 1.004.
[2] Mean of 147 time series regressions of up to 28 observations each.
[3] Median of 147 time series regressions of up to 28 observations each.
[4] Mean of 154 time series regressions of up to 28 observations each, assuming first order autoregression in the residual term
[5] Median of 154 time series regressions of up to 28 observations each, assuming first order autoregression in the residual term
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. Tests of means and pooled regressions are t tests; tests of medians are nonparametric sign tests. (One tail tests except for the intercept which is two tail.)

Table C.17: Evidence on the relation between cash flow from operating and non-operating activities, the change in dividends, and the change in firm value, when intercept set to 0 and the association period is months 1 to 3 (the quarter itself) after eliminating 6 outliers

$$\begin{aligned} \text{Returns} &= b_1 * \text{Cash and investments} + b_2 * \text{Operating cash flow} \\ &+ b_3 * \text{Change in dividends} \end{aligned}$$

Case	b_1	b_2	b_3
Predicted	+	1	+
Pooled[1]	0.179	0.150	8.574
	.000	.000	.004
Mean t.s.[2]	0.910	0.294	-11.548
	.000	.002	.872
Median t.s.[3]	0.484	0.202	0.000
	.000	.000	
Mean t.s.a.[4]	0.940	0.192	-18.164
	.000	.096	.962
Median t.s.a.[5]	0.487	0.210	0.000
	.000	.000	

Notes:
See table C.11 for proxy definitions.
[1] 3475 observations.
White's χ^2 statistic = .0109, Largest variance inflation factor = 1.000.
[2] Mean of 153 time series regressions of up to 28 observations each.
[3] Median of 153 time series regressions of up to 28 observations each.
[4] Mean of 154 time series regressions of up to 28 observations each, assuming first order autoregression in the residual term
[5] Median of 154 time series regressions of up to 28 observations each, assuming first order autoregression in the residual term
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. Tests of means and pooled regressions are t tests; tests of medians are nonparametric sign tests. (One tail tests except for the intercept which is two tail.)

Table C.18: Evidence on the relation between cash flow from operating and non-operating activities, the change in dividends, and the change in firm value, when association period is months 2 to 4

$$\text{Returns} = b_0 + b_1 * \text{Cash and investments} + b_2 * \text{Operating cash flow} + b_3 * \text{Change in dividends}$$

Case	b_0	b_1	b_2	b_3
Predicted	0	+	1	+
Pooled[1]	0.042	0.042	-0.002	6.236
	.000	.022	.531	.022
Mean t.s.[2]	-0.010	0.701	0.102	0.509
	.211	.000	.040	.482
Median t.s.[3]	-0.002	0.426	0.007	0.333
	.805	.000	.074	.167
Mean t.s.a.[4]	-0.008	0.646	0.124	-0.958
	.334	.000	.017	.532
Median t.s.a.[5]	0.000	0.392	0.081	0.000
	.934	.000	.012	
Mean c.s.[6]	0.037	0.008	0.098	23.606
	.093	.380	.017	.000
Median c.s.[7]	0.033	0.016	0.057	19.311
	.079	.259	.036	.000

Notes:
See table C.11 for proxy definitions.
[1] 3571 observations.
Adjusted $R^2 = .0015$, White's χ^2 statistic = .0308, Largest variance inflation factor = 1.002.
[2] Mean of 154 time series regressions of up to 28 observations each.
[3] Median of 154 time series regressions of up to 28 observations each.
[4] Mean of 153 time series regressions of up to 28 observations each, assuming first order autoregression in the residual term
[5] Median of 153 time series regressions of up to 28 observations each, assuming first order autoregression in the residual term
[6] Mean of 28 cross sectional regressions of up to 270 observations each.
[7] Median of 28 cross sectional regressions of up to 270 observations each.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. Tests of means and pooled regressions are t tests; tests of medians are nonparametric sign tests. (One tail tests except for the intercept which is two tail.)

Table C.19: Evidence on the relation between cash flow from operating and nonoperating activities, the change in dividends, and the change in firm value, when intercept set to 0 and the association period is months 2 to 4

$$\begin{aligned} \text{Returns} &= b_1 * \text{Cash and investments} + b_2 * \text{Operating cash flow} \\ &+ b_3 * \text{Change in dividends} \end{aligned}$$

Case	b_1	b_2	b_3
Predicted	+	1	+
Pooled[1]	0.202	0.044	9.062
	.000	.034	.002
Mean t.s.[2]	0.708	-0.049	11.940
	.000	.614	.151
Median t.s.[3]	0.474	0.030	1.268
	.000	.076	.056
Mean t.s.a.[4]	0.654	-0.024	12.810
	.000	.558	.151
Median t.s.a.[5]	0.457	0.026	1.793
	.000	.031	.062
Mean c.s.[6]	0.127	0.134	29.470
	.042	.067	.016
Median c.s.[7]	0.182	-0.006	21.279
	.004	.843	.000

Notes:
See table C.11 for proxy definitions.
[1] 3571 observations. White's χ^2 statistic = .1331, Largest variance inflation factor = 1.000.
[2] Mean of 160 time series regressions of up to 28 observations each.
[3] Median of 160 time series regressions of up to 28 observations each.
[4] Mean of 160 time series regressions of up to 28 observations each, assuming first order autoregression in the residual term
[5] Median of 160 time series regressions of up to 28 observations each, assuming first order autoregression in the residual term
[6] Mean of 28 cross sectional regressions of up to 270 observations each.
[7] Median of 28 cross sectional regressions of up to 270 observations each.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. Tests of means and pooled regressions are t tests; tests of medians are nonparametric sign tests. (One tail tests except for the intercept which is two tail.)

Table C.20: Tests of hypotheses H7 to H9: evidence of variation in the dividend response coefficient due to cross sectional variation in firm payout rates, firm growth rates, and firm betas: probability (1 tail) of observing the difference in the mean (t test) or the mean rank (Wilcoxon test) of the dividend response coefficients between the first and fourth quartiles of the rates, given the null hypotheses of no difference.

Original	Payout rate		Div growth rate		OCF growth rate		Beta	
regression has	t test	W test	t test	W test	t test	W test	t test	W test
Returns measured over months 1 to 12								
With intercept								
OLS	.084	.172	.002	.001	.724	.181	.256	.253
AR(1)	.097	.202	.009	.001	.687	.158	.286	.253
Without intercept								
OLS	.114	.191	.000	.000	.258	.036	.219	.089
AR(1)	.160	.354	.002	.000	.177	.022	.248	.140
Returns measured over months 3 to 14								
With intercept								
OLS	.003	.034	.017	.001	.060	.078	.038	.212
AR(1)	.004	.049	.011	.000	.061	.058	.041	.266
Without intercept								
OLS	.003	.028	.007	.009	.029	.034	.009	.061
AR(1)	.010	.082	.006	.007	.012	.027	.019	.156

Table C.21: Tests of hypotheses H7 to H9: evidence on the cross-sectional variation in dividend response coefficients, when association period is the year

$$\text{Response coefficient} = b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} + b_3 * \text{Dividend growth rate}$$

Obs Predicted	b_0	b_1 −	b_2 −	b_3 +	Adjusted R^2	White's χ^2	Largest VIF
All	34.804	-38.098	-15.486	235.494	.0159	.1366	1.033
249	.383	.141	.336	.016			
Pos	89.681	-90.339	14.970	123.967	.0304	.1024	1.024
91	.020	.017	.664	.179			
Log	2.404	-1.263	0.264	-2.856	.1037	.5417	1.032
91	.000	.000	.653	.811			
When original regression has residual term autoregressive							
All	40.927	-55.111	-17.942	236.338	.0116	.3625	1.033
249	.401	.101	.343	.038			
Pos	100.851	-76.130	7.203	83.424	.0005	.3748	1.013
88	.018	.054	.574	.280			
Log	2.717	-1.123	-0.374	-4.441	.0857	.5720	1.024
88	.000	.001	.306	.903			
When original regression has intercept set to zero							
All	44.148	-42.608	-32.972	167.014	.0257	.1912	1.033
249	.146	.057	.117	.022			
Pos	52.604	-56.939	20.273	88.990	.0201	.4243	1.016
101	.057	.030	.786	.187			
Log	2.446	-1.102	0.511	-4.498	.1059	.7505	1.024
101	.000	.000	.807	.936			
When original regression has intercept set to zero, and residual term autoregressive							
All	45.459	-51.468	-32.733	173.120	.0194	.3373	1.033
249	.211	.056	.162	.041			
Pos	39.944	-27.018	21.679	98.970	.0000	.2693	1.009
102	.159	.187	.797	.168			
Log	2.606	-0.786	0.123	-3.341	.0359	.4651	1.012
102	.000	.008	.574	.846			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table C.22: Evidence on the cross-sectional variation in dividend response coefficients, when association period is the year

$$\text{Response coefficient} = b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} + b_3 * \text{Operating cash flow growth rate}$$

Obs Predicted	b_0	b_1 −	b_2 −	b_3 +	Adjusted R^2	White's χ^2	Largest VIF
All	67.961	-66.778	-15.069	-113.842	.0175	.2618	1.049
249	.088	.031	.340	.987			
Pos	113.130	-93.528	22.864	-126.561	.0501	.3773	1.004
91	.004	.014	.746	.947			
Log	2.712	-1.272	0.237	-4.036	.1378	.5964	1.010
91	.000	.000	.641	.979			
When original regression has residual term autoregressive							
All	76.628	-86.342	-17.661	-131.390	.0172	.4577	1.049
249	.114	.024	.346	.983			
Pos	120.300	-80.919	19.362	-143.524	.0315	.2668	1.026
88	.004	.042	.696	.958			
Log	2.923	-1.150	-0.241	-4.267	.1113	.7506	1.034
88	.000	.001	.371	.978			
When original regression has intercept set to zero							
All	59.736	-54.947	-32.226	-24.743	.0112	.2660	1.049
249	.050	.022	.124	.738			
Pos	67.686	-56.807	22.422	-65.444	.0260	.3678	1.014
101	.014	.030	.811	.879			
Log	2.427	-1.014	0.510	-1.789	.0941	.7385	1.003
101	.000	.001	.804	.849			
When original regression has intercept set to zero, and residual term autoregressive							
All	60.566	-63.196	-31.900	-18.220	.0078	.4234	1.049
249	.097	.027	.170	.653			
Pos	55.954	-26.951	23.797	-64.944	.0000	.3326	1.010
102	.047	.187	.820	.876			
Log	2.716	-0.746	0.151	-2.354	.0411	.6573	1.002
102	.000	.010	.591	.894			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table C.23: Evidence on the cross-sectional variation in dividend response coefficients, when association period is months 3 to 14

$$\text{Response coefficient} = b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} + b_3 * \text{Dividend growth rate}$$

Obs Predicted	b_0	b_1 −	b_2 −	b_3 +	Adjusted R^2	White's χ^2	Largest VIF
All	119.048	-116.476	-91.506	163.444	.0517	.1047	1.033
249	.011	.003	.017	.101			
Pos	113.268	-116.488	-12.201	358.326	.0711	.6940	1.014
83	.016	.019	.386	.019			
Log	2.888	-0.644	0.031	-0.392	.0057	.5778	1.016
83	.000	.034	.519	.547			
When original regression has autoregressive residual term							
All	115.018	-121.411	-87.406	182.191	.0510	.1033	1.033
249	.018	.002	.024	.084			
Pos	60.414	-54.812	-2.294	620.151	.0795	.6244	1.134
82	.300	.199	.479	.006			
Log	2.986	-0.086	0.418	7.698	.0276	.7150	1.148
82	.000	.402	.702	.024			
When intercept in original regression set to zero							
All	128.443	-107.719	-111.826	122.654	.0839	.0669	1.033
249	.001	.001	.001	.117			
Pos	4.843	-26.917	38.294	462.849	.0573	.1179	1.110
83	.916	.292	.844	.009			
Log	3.072	0.097	1.168	7.591	.0529	.2997	1.121
83	.000	.624	.976	.019			
When original regression has intercept set to zero, and residual term autoregressive							
All	111.291	-98.656	-95.051	136.102	.0632	.0526	1.033
249	.004	.002	.004	.101			
Pos	1.526	-4.714	25.749	570.988	.0684	.1120	1.118
87	.974	.464	.746	.003			
Log	2.783	0.001	0.781	9.039	.0569	.5233	1.126
87	.000	.501	.909	.008			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table C.24: Evidence on the cross-sectional variation in dividend response coefficients, when association period is months 3 to 14

$$\begin{aligned}\text{Response coefficient} &= b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} \\ &+ b_3 * \text{Operating cash flow growth rate}\end{aligned}$$

Obs Predicted	b_0	b_1 –	b_2 –	b_3 +	Adjusted R^2	White's χ^2	Largest VIF
All	134.643	-128.894	-90.794	-26.617	.0461	.7023	1.049
249	.004	.001	.018	.672			
Pos	144.504	-117.410	0.710	-76.099	.0282	.3804	1.051
83	.002	.021	.506	.808			
Log	3.082	-0.641	0.121	-1.414	.0138	.5090	1.032
83	.000	.033	.572	.790			
When original regression has autoregressive residual term							
All	132.592	-135.446	-86.624	-31.010	.0446	.5824	1.049
249	.006	.001	.026	.693			
Pos	144.850	-109.860	-8.790	-44.002	.0040	.3245	1.020
82	.006	.043	.426	.673			
Log	3.343	-0.324	0.291	-0.274	.0000	.2083	1.024
82	.000	.167	.679	.563			
When intercept in original regression set to zero							
All	129.620	-106.412	-110.694	54.392	.0834	.2423	1.049
249	.001	.001	.001	.128			
Pos	64.486	-60.072	32.298	-38.734	.0000	.3508	1.037
83	.112	.110	.794	.696			
Log	3.436	-0.097	0.991	-0.328	.0007	.5344	1.028
83	.000	.372	.951	.583			
When original regression has intercept set to zero, and residual term autoregressive							
All	112.417	-97.024	-93.786	61.624	.0629	.3189	1.049
249	.004	.003	.004	.106			
Pos	69.452	-51.141	21.027	-10.837	.0000	.5952	1.034
87	.110	.162	.694	.554			
Log	3.090	-0.246	0.603	0.487	.0000	.6680	1.026
87	.000	.210	.841	.379			

Notes:

Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table C.25: Evidence on the cross-sectional variation in dividend response coefficients, when association period is the quarter

$$\text{Response coefficient} = b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} + b_3 * \text{Dividend growth rate}$$

Obs Predicted	b_0	b_1 $-$	b_2 $-$	b_3 $+$	Adjusted R^2	White's χ^2	Largest VIF
All	-266.719	-2.251	-80.188	336.210	.0000	.6689	1.020
154	.734	.366	.084	.332			
Pos	-524.506	-72.774	-88.588	724.970	.0043	.9391	1.139
69	.571	.180	.133	.209			
Log	3.693	-0.680	0.056	20.437	.1280	.5386	1.048
69	.000	.202	.543	.001			
When original regression has residual term autoregressive							
All	-272.799	-2.074	-72.383	333.189	.0000	.6624	1.020
154	.727	.376	.106	.332			
Pos	-551.893	-64.521	-107.540	765.693	.0094	.9528	1.133
70	.551	.207	.094	.196			
Log	3.351	-0.203	0.077	23.633	.1108	.3775	1.043
70	.000	.414	.550	.001			
When original regression has intercept set to zero							
All	-314.406	-2.106	-79.331	376.178	.0000	.5575	1.018
160	.684	.373	.071	.309			
Pos	-581.967	-90.954	-64.185	763.652	.0445	.5672	1.123
73	.414	.061	.147	.133			
Log	4.147	-1.794	0.384	20.507	.1903	.6477	1.046
73	.000	.012	.780	.001			
When original regression has intercept set to zero, and residual term autoregressive							
All	-157.956	-2.177	-84.069	224.131	.0000	.6148	1.018
159	.844	.374	.068	.388			
Pos	-440.333	-84.254	-78.773	636.066	.0216	.6988	1.123
72	.581	.102	.133	.204			
Log	3.887	-1.356	0.366	22.474	.1618	.6220	1.047
72	.000	.056	.742	.001			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table C.26: Evidence on the cross-sectional variation in dividend response coefficients, when association period is the quarter and after eliminating 6 outliers

$$\text{Response coefficient} = b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} + b_3 * \text{Dividend growth rate}$$

Obs Predicted	b_0	b_1 $-$	b_2 $-$	b_3 $+$	Adjusted R^2	White's χ^2	Largest VIF
All	-80.618	-1.262	17.714	54.907	.0000	.0959	1.020
147	.851	.361	.708	.448			
Pos	-747.571	-25.631	52.972	759.098	.1370	.4396	1.137
66	.022	.177	.966	.008			
Log	3.518	-0.440	0.519	19.840	.1547	.4971	1.047
66	.000	.277	.856	.000			
When original regression has residual term autoregressive							
All	-1772.267	-3.832	-132.912	1885.660	.0045	.9923	1.019
154	.216	.374	.096	.090			
Pos	-2006.451	-194.061	-282.464	2464.419	.0287	.9961	1.136
69	.388	.163	.089	.136			
Log	3.313	-0.216	0.300	25.309	.1352	.5911	1.044
69	.000	.407	.682	.000			
When original regression has intercept set to zero							
All	-106.824	-1.532	-12.980	107.661	.0000	.3197	1.018
153	.848	.371	.372	.422			
Pos	-744.503	-55.450	19.252	809.983	.0814	.7097	1.121
70	.092	.063	.690	.028			
Log	3.994	-1.569	0.778	20.108	.2170	.3823	1.044
70	.000	.017	.944	.000			
When original regression has intercept set to zero, and residual term autoregressive							
All	-16.259	-1.698	-6.797	5.586	.0000	.3197	1.019
154	.977	.359	.432	.496			
Pos	-660.906	-44.346	37.284	702.490	.0797	.7021	1.120
69	.094	.087	.849	.032			
Log	3.726	-1.126	0.851	22.066	.1906	.6535	1.044
69	.000	.077	.939	.000			

Notes:
The firms with three of the five highest and three of the five lowest DRCs were deleted. Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table C.27: Evidence on the cross-sectional variation in dividend response coefficients, when association period is months 2 to 4

$$\begin{aligned} \text{Response coefficient} &= b_0 + b_1 * \text{Dividend payout rate} + b_2 * \text{Beta} \\ &+ b_3 * \text{Dividend growth rate} \end{aligned}$$

Obs Predicted	b_0	b_1 $-$	b_2 $-$	b_3 $+$	Adjusted R^2	White's χ^2	Largest VIF
All	-503.359	-0.752	-65.481	563.178	.0000	.3374	1.020
154	.430	.444	.083	.184			
Pos	-1047.633	8.976	80.859	1023.917	.0690	.5864	1.513
76	.094	.576	.986	.043			
Log	3.726	-0.946	0.824	19.070	.1148	.3271	1.558
76	.000	.222	.941	.022			
When original regression has autoregressive residual term							
All	-543.244	-0.783	-67.909	603.544	.0000	.3302	1.020
153	.406	.443	.080	.174			
Pos	-906.119	-2.061	69.219	902.744	.0556	.6329	1.606
74	.158	.483	.972	.070			
Log	4.088	-1.513	0.352	15.094	.1058	.4174	1.664
74	.000	.106	.759	.055			
When intercept in original regression set to zero							
All	-874.599	-0.919	-94.581	970.118	.0264	.3148	1.018
160	.168	.431	.017	.060			
Pos	-1255.602	-7.773	43.643	1291.176	.0300	.7548	1.119
80	.061	.441	.809	.023			
Log	3.258	0.434	0.803	30.724	.2227	.2080	1.047
80	.000	.713	.956	.000			
When original regression has intercept set to zero, and residual term autoregressive							
All	-994.034	-1.280	-116.012	1110.442	.0375	.3995	1.018
160	.143	.411	.007	.048			
Pos	-1316.066	-31.253	10.337	1397.394	.0121	.8571	1.597
80	.236	.354	.567	.093			
Log	3.868	-0.727	0.548	20.783	.1034	.1738	1.654
80	.000	.288	.864	.016			

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run. The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table C.28: Evidence of variation in the dividend response coefficient due to cross sectional variation in firm payout rates, firm dividend growth rates and firm betas, and due to time series variation in the risk free rate: probability (1 tail) of observing the difference in the mean (t test) or the mean rank (Wilcoxon test) of the dividend response coefficients between the first and fourth quartiles of the rates, given the null hypotheses of no difference.

Original	Payout rate		Growth rate		Beta		Interest rate	
regression has	t test	W test	t test	W test	t test	W test	t test	Wilcoxon test
Returns measured over months 1 to 3								
With intercept								
OLS	.170	.051	.064	.034	.152	.437	.059	.048
AR(1)	.166	.028	.062	.017	.168	.558		
Without intercept								
OLS	.208	.104	.181	.164	.079	.212	.229	.101
AR(1)	.232	.086	.246	.123	.101	.282		
Returns measured over months 2 to 4								
With intercept								
OLS	.812	.472	.120	.057	.074	.159	.104	.304
AR(1)	.767	.424	.106	.054	.079	.231		
Without intercept								
OLS	.685	.494	.062	.014	.020	.038	.006	.002
AR(1)	.587	.477	.060	.026	.029	.028		

Table C.29: Evidence on the time series variation in dividend response coefficients, when association period is the quarter

$$\text{Dividend response coefficient} = b_0 + b_1 * \text{Interest rate}$$

Obs Predicted	b_0	b_1 –	Adjusted R^2	White's χ^2
All	89.473	-6.889	.1844	.5267
28	.006	.007		
Pos	93.612	-6.527	.1677	.4344
21	.009	.019		
Log	9.793	-3.176	.0750	.4775
21	.049	.061		
When intercept in original regression set to zero				
All	156.098	-12.178	.1019	.0765
28	.031	.027		
Pos	255.764	-18.514	.4907	.0815
18	.000	.000		
Log	12.509	-3.828	.5425	.3363
18	.000	.000		

Notes:
Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run.
The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table C.30: Evidence on the time series variation in dividend response coefficients, when association period is months 2 to 4

Dividend response coefficient $= b_0 + b_1 *$ Interest rate

Obs Predicted	b_0	b_1 –	Adjusted R^2	White's χ^2
All	77.600	-4.862	.1327	.0321
28	.004	.016		
Pos	79.816	-4.660	.1495	.0300
24	.003	.018		
Log	3.894	-0.468	.0000	.2086
24	.257	.371		
When intercept in original regression set to zero				
All	159.963	-11.751	.1012	.2718
28	.023	.028		
Pos	211.824	-14.500	.4781	.1764
21	.000	.000		
Log	13.007	-4.049	.4489	.3986
21	.000	.000		

Notes:

Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run.

The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table C.31: Evidence on the time series variation in dividend response coefficients, when association period is the year

$$\text{Dividend response coefficient} = b_0 + b_1 * \text{Interest rate}$$

Obs Predicted	b_0	b_1 –	Adjusted R^2	White's χ^2
All	-0.540	7.076	.0000	.4123
7	.806	.636		
Pos	-0.722	12.372	.0000	.2731
4	.823	.658		
Log	9.863	5.374	.0118	.1953
4	.500	.792		
When intercept in original regression set to zero				
All	-0.823	10.797	.0000	.3784
7	.646	.740		
Pos	-0.714	10.771	.0000	.2069
6	.702	.731		
Log	8.024	4.553	.0856	.2257
6	.400	.854		

Notes:

Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run.

The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

Table C.32: Evidence on the time series variation in dividend response coefficients, when association period is months 3 to 14

$$\text{Dividend response coefficient} = b_0 + b_1 * \text{Interest rate}$$

Obs Predicted	b_0	b_1 –	Adjusted R^2	White's χ^2
All	-1.866	22.992	.0000	.2428
7	.526	.797		
Pos	0.347	6.778	.0000	.7221
4	.961	.544		
Log	8.062	4.057	.0000	.5569
4	.608	.711		
When intercept in original regression set to zero				
All	-1.997	25.556	.0000	.2908
7	.614	.754		
Pos	-1.172	21.140	.0000	.3984
5	.817	.675		
Log	12.600	6.270	.2423	.2551
5	.271	.886		

Notes:

Obs gives number of firms used in the regression: "pos" indicates that only observations with positive values for the dependent and independent variables were used, "log" indicates that a logarithm transformation was applied to all variables before the regression was run.

The second row of each pair of rows gives the probability of observing the regression coefficient above, given the null hypothesis that the coefficient is zero. (One tail t tests except for the intercept which is two tail.)

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INTERESTS

Research	Relations between accounting information and market values
Teaching	Financial accounting, including intermediate, advanced, and accounting research; finance

EDUCATION

1988 to date	Ph.D. student, University of Washington
	Dissertation topic:
	"Dividends and earnings: Their effect on firm value"
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	Major Area: Financial accounting
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	Cumulative GPA: 3.82 (out of 4.00)
1987	M.Sc. Accounting, Saskatchewan
1976	M.A. Economics, Western Ontario
1973	B.A. Computing Science, Victoria

PROFESSIONAL DESIGNATION

Chartered Accountant (British Columbia)

ACADEMIC HONOURS

1990	Lorig Accounting Research Scholarship
	PAC-10 Doctoral Consortium
1989	Dean's Achievement Award
1988	Entrance Scholarship, University of Washington
1988-90	Institute of Chartered Accountants of Ontario doctoral support program
1987	University of Saskatchewan Graduate Scholarship

TEACHING EXPERIENCE

1988-90	Teaching assistant at University of Washington for Introduction to accounting and Introduction to financial accounting
1988-89	Lecturer at University of Saskatchewan for Introduction to financial accounting and Intermediate financial accounting
1982-84	Teaching review seminars in advanced accounting for Thorne Riddell, Chartered Accountants

EMPLOYMENT HISTORY

1984-87	Controller for some small companies in Victoria
1979-84	Public accountant in Victoria
1973-75	Personnel Officer, Canadian government, Ottawa

REFERENCES

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