Corporate Financial Policy, Information, and Market Expectations: An Empirical Investigation of Dividends
Author(s): Aharon R. Ofer and Daniel R. Siegel
Source: *The Journal of Finance*, Vol. 42, No. 4 (Sep., 1987), pp. 889-911
Published by: Blackwell Publishing for the American Finance Association
Stable URL: http://www.jstor.org/stable/2328297
Accessed: 26/11/2009 08:12

THE JOURNAL OF FINANCE • VOL. XLII, NO. 4 • SEPTEMBER 1987

Corporate Financial Policy, Information, and Market Expectations: An Empirical Investigation of Dividends

AHARON R. OFER and DANIEL R. SIEGEL*

ABSTRACT

This paper documents a relationship between announcements of unexpected changes in financial policy and unexpected changes in performance of the firm. Using a new methodology that combines analysis of stock price movements and earnings forecast data, the authors provide evidence that analysts revise their earnings forecasts following the announcement of an unexpected dividend change by an amount positively related to the size of the unexpected dividend change. They also provide evidence that these revisions are positively related to the change in equity value surrounding the announcement. Further, they find that these revisions are consistent with rationality. Their results therefore provide direct evidence consistent with the hypothesis that unexpected dividend changes signal information about firm performance to market participants.

A FUNDAMENTAL QUESTION IN corporate finance is whether changes in corporate financial policy convey information about firm performance to capital markets. Empirical work that addresses this issue has yielded puzzling results. There are well-documented price reactions to announcements of changes in financial policy. Empirical researchers have employed event-study methodology to demonstrate that abnormal security price changes follow announcements of changes in a wide variety of financial policies.[1] These results suggest that changes in corporate financial policy might convey information about firm performance. However, studies using other methodologies have yielded different results. For example, Watts [39] and Gonedes [14] are unable to find an economically significant relationship between dividends and subsequent earnings of the firm.

In this paper, we document a relationship between announcements of unexpected changes in financial policy and unexpected changes in firm performance.

* Ofer is from Northwestern University and Tel Aviv University. Siegel is from Northwestern University. We would like to thank Ken Eades, Larry Glosten, Milton Harris, Robert Heinkel, Robert Hodrick, Gur Huberman, Ravi Janannathan, Kose John, Robert Korajczyk, Shmuel Kandel, Bruce Lehmann, Thomas Lys, Robert McDonald, Pat O'Brien, Richard Ruback, and an anonymous referee, as well as the participants of the Finance Workshops at A.G.S.M., Berkeley, Chicago, Columbia, Duke/North Carolina, M.I.T., Northwestern, Oregon, U.S.C., Washington, and Wisconsin for their helpful comments. We would also like to thank the Banking Research Center at Northwestern and the Israeli Center for Research in Business for support for this work. The usual disclaimer applies.

[1] Examples include studies of stock splits (Fama, Fisher, Jensen, and Roll [12] and Grinblatt, Masulis, and Titman [15]), dividend changes (Pettit [35, 36], Laub [23], Charest [8], Aharony and Swary [2], Asquith and Mullins [3], Eades [9], Brickley [6], Kane, Lee, and Marcus [22], and Eades, Kim, and Hess [10]), calls of convertible bonds (Mikkelson [27]), repurchases of shares (Vermaelen [38]), and capital structure changes (Masulis [26]).

Using a new methodology that combines analysis of stock price movements and earnings forecast data, we provide evidence that analysts revise their forecasts following the announcement of an unexpected dividend change by an amount positively related to the size of the unexpected dividend change. We also show that these revisions are positively related to the change in equity value surrounding the announcement. We find that these revisions are consistent with rationality. These results indicate that there is a positive systematic relationship between announcements of unexpected changes in dividends and unexpected changes in the level of earnings.

Our methodology differs in important ways from event-study methodology, which has been employed to test for the information content of changes in financial policy. Event-study methodology attempts to identify information content by examining security price reactions to announcements of policy changes. It cannot, however, differentiate whether these stock price reactions are caused by information about economic performance of the firm or by other factors that are also consistent with the observed price reactions. For example, Handjinicolaou and Kalay [16][2] have suggested that the abnormal price reactions associated with announcements of changes in dividends reflect the impact of wealth transfers between bondholders and stockholders. In this scenario, there is no change in cash flows of the firm and we should not observe any revision in analyst forecasts. Our results are not consistent with this alternative model as an exclusive explanation for the abnormal stock returns associated with the announcement of dividend changes. Our methodology also allows us to gain insight into the characteristics of the information that is being released by changes in a particular financial policy variable. Abnormal excess returns following the announcement of a change in financial policy might be caused by one or more of several factors. For example, the policy change might convey information about changes in the discount rate to be applied to cash flows or in the expected growth rate of future cash flows. Alternatively, the policy change might convey information about the expected level of cash flows. Our results are consistent with the latter.

Recently, other studies have also documented a relationship between announcements of changes in corporate financial policy and subsequent firm performance. Ofer and Natarajan [32] find a decline in subsequent profitability of the firm following calls of convertible bonds. Similarly, Lys and Sivaramakrishnan [25] find negative unexpected earnings following announcements of equity-for-debt swaps. Aharony and Dotan [1] and Healy and Palepu [18] find a positive association between unexpected dividend changes and subsequent unexpected earnings of the firm. These studies use *ad hoc* models of performance expectations as a benchmark in order to identify unexpected changes in performance. In using analyst earnings forecasts as a proxy for market expectations, our methodology has two important advantages over that used by previous studies. First, Brown and Rozeff [7] and Fried and Givoly [13] show that financial

[2] Handjinicolaou and Kalay use event-study methodology to test additional implications of dividend signalling by examining the effect of announcements of dividend changes on bond prices. Their results are not conclusive but suggest the plausibility of the signalling hypothesis.

analysts' forecasts of earnings are a better proxy for market expectations than are time-series models. Thus, we are able to obtain better estimates of unexpected performance. Our main contribution, however, is that we are able to examine directly whether announcements of changes in corporate financial policy are associated with revisions in market expectations of cash flows and whether these revisions are consistent with rationality.

Our results have important implications regarding a number of models that have been developed to explain security price reactions to announcements of changes in corporate financial policy. Rational signalling models have been constructed to explain stock price reactions to changes in capital structure (Leland and Pyle [24] and Ross [37]), dividend changes (Bhattacharya [4, 5], John and Williams [21], Miller and Rock [28], and Ofer and Thakor [34]), calls of convertibles (Harris and Raviv [17]), and others. Similarly, Myers and Majluf [30] propose that equity financing by the firm conveys negative information about the firm's prospects.[3] These models explain the security price reactions to announcements of policy changes by postulating that these announcements release information to the market that was previously privately held by management. In the models, the observed abnormal returns follow as market participants rationally revise their expectations and act upon these revised expectations in security markets. However, there is to date no direct evidence that market participants actually do revise their expectations following these announcements. Our results do provide this kind of direct evidence and thus furnish evidence consistent with these signalling models, over and above the security market reactions that originally motivated them.

Section I presents a model of information release that predicts the relationship between revisions in forecasts following an announcement of an unexpected change in dividends and the size of the unexpected change in the dividends. Section II discusses the empirical test of the model. Section III presents the empirical results. Section IV provides an alternative test that examines the relationship between revisions in earnings forecasts and changes in equity value surrounding the dividend announcement. Section V concludes.

I. The Model

We now develop a model to test whether analysts update their forecasts of earnings following an announcement of an unexpected dividend change and whether they do so in a manner consistent with rationality. Our data set includes monthly *consensus* forecasts of fiscal year endings. Our modeling proceeds in two stages. First, we derive restrictions on *individual* forecasts. Second, we show how combining these individual forecasts into a consensus forecast modifies these restrictions and provides testable restrictions on the behavior of consensus forecasts.

[3] In Huberman [20], firms change their financial policy as a result of changes in cash flows. Huberman suggests that this type of mechanism can also explain the stock price reactions discussed above.

A. The Behavior of Individual Forecasts

Consider the following time line around the announcement of an *unexpected* change in dividends:

$$\begin{array}{ccccccccccc} * & \text{———} & * & \text{———} & * & \text{———} & * & \text{———} & * & \text{———} & *. \\ t_b - j & & t_b & & 0 & & t_a & & t_a + k & & T \end{array}$$

0 is the date of the announcement of an unexpected change in dividends.
T is the date of the announcement of earnings for the fiscal year ending after the dividend announcement at 0.
t_b is the date of the last forecast of (time-T) earnings before the dividend announcement at 0.
$t_b - j$ is the date of the forecast of (time-T) earnings j months before t_b.
t_a is the date of the first forecast of (time-T) earnings after the dividend announcement at 0.
$t_a + k$ is the date of the forecast of (time-T) earnings k months after t_a.

In our data set, earnings forecasts for a given fiscal year are provided on a monthly basis up to the announcement at T. For inclusion in our data set, we must require that a forecast at $t_a + k$ satisfy $T > t_a + k$. Subscripts j and k refer to forecasts made before and after date 0, respectively.

Let the individual forecasts of firm i's fiscal year earnings announced at T, at time $t_b - j$ and $t_a + k$, be given by the conditional expectations

$$P^f_{i,t_b-j} = \mathrm{E}_{t_b-j}[P_i] \tag{1}$$

and

$$P^f_{i,t_a+k} = \mathrm{E}_{t_a+k}[P_i], \tag{2}$$

where

P_i is the realized actual earnings for firm i announced at T,
P^f_{i,t_b-j} is the forecast of (time-T) earnings for firm i at $t_b - j$,
P^f_{i,t_a+k} is the forecast of (time-T) earnings for firm i at $t_a + k$, and
$\mathrm{E}_s[\cdot]$ is the *mathematical* expectation at s, given all information available to market analysts at s, $s = t_b - j, \cdots, t_b, t_a, \cdots, t_a + k$.

The assumption that forecasts are conditional expectations of earnings (to be announced at T) based upon all available public information is not a necessary assumption for our analysis, and, in fact, we will test this assumption below. It does, however, simplify the exposition.[4]

Now, define the forecast error for the $t_b - j$ forecast as

$$FE_{i,t_b-j} = P_i - P^f_{i,t_b-j}. \tag{3}$$

Then the forecast error for the $t_b - j$ forecast can be written as the sum of all revisions in expectation between $t_b - j$ and T:

$$FE_{i,t_b-j} = W_i + \gamma_{i,j} + \varepsilon_{i,t_a}, \tag{4}$$

[4] We would expect forecasts to be unbiased only if forecasters have symmetric loss functions.

where

W_i is the revision in expectation as a result of information embodied in the dividend announcement;

$\gamma_{i,j}$ is the revision in expectation between dates $t_b - j$ and t_a, as a result of information other than that embodied in the dividend announcement. When attached to γ, the subscript j refers exclusively to the $(j + 1)$-month interval between dates $t_b - j$ and t_a;

$\varepsilon_{i,s}$ is the revision in expectation between dates s and T. When attached to ε, the subscript s refers exclusively to the interval of length $T - s$ between dates s and T.

For our test, we distinguish between the revision in expectation caused by information released by the unexpected dividend change and revisions caused by other information released during the period between $t_b - j$ and t_a. By construction, W_i, $\gamma_{i,j}$, and ε_{t_a} will be mutually independent.

There will be a similar equation for the forecast error for the time $t_a + k$ forecasts (made after date 0):

$$FE_{i,t_a+k} = \varepsilon_{i,t_a+k}. \tag{5}$$

Equation (4) predicts that forecasts made before the announcement of an unexpected dividend change will exhibit a forecast error systematically related to the revision in expectation due to information released by the dividend announcement. Equation (5) predicts that this systematic relationship should disappear for forecasts made after the dividend announcement. Evidence consistent with equations (4) and (5) would indicate that, following these announcements, forecasters update their expectations in a rational manner. Examining each of these predictions will require specifying a relationship between the (unobservable) change in expectation due to information released by the dividend change, W_i, and observable variables.

B. Tests of Equation (4)

An obvious candidate for an observable variable to measure W_i is the unexpected dividend change itself. If the unexpected change in dividends conveys information about earnings to be announced at T, then *ceteris paribus*, we might expect a larger change in expected earnings to be conveyed by a larger unexpected change in the dividend. This is, for example, a necessary feature of the dividend-signalling models discussed above.

Suppose that the unexpected dividend change, ΔD_i, used by the firm to convey an update in expectation, W_i, is given by the following relationship:

$$\Delta D_i = (\bar{\nu} + \nu_i) W_i, \tag{6}$$

where

$\bar{\nu}$ is the cross-sectional average of the multiplier applied by firms to W_i to derive the unexpected change in the dividend.

ν_i is a firm-specific disturbance around the mean $\bar{\nu}$, assumed to have zero mean and to be i.i.d. across firms and independent of W_i.

The firm-specific multiplier $\bar{\nu} + \nu_i$ will depend upon firm characteristics and the nature of the information being conveyed. For example, in the Bhattacharya [4] dividend-signalling model, for a given increase in expected earnings, a firm with less cash reserves will signal with a smaller increase in dividends. Similarly, a firm expecting a permanent increase in earnings will presumably use a larger multiplier than one expecting a transitory increase because it will have more cash inflow overall. Notice that, in (6), both the unexpected change in dividends, ΔD_i, and the revision in expectation, W_i, are in terms of dollars per share. This is consistent with the feature of dividend-signalling models that large dollar dividend increases are used to signal large dollar increases in cash flows.

Inverting (6) yields an expression for the revision in expectation from the information released by the dividend:

$$W_i = \alpha^d \Delta D_i - \alpha^d \nu_i W_i, \tag{7}$$

where $\alpha^d = 1/\bar{\nu}$.

Note that, if $\alpha^d = 0$, then there is no information about expected levels of cash flows embodied in the dividend announcement. Combining (4) and (7) yields an expression for the forecast error in terms of the observable variable ΔD_i:

$$FE_{i,t_b-j} = \alpha^d \Delta D_i - \alpha^d \nu_i W_i + \gamma_{i,j} + \varepsilon_{i,t_a}. \tag{8}$$

Equation (8) therefore describes forecast errors for individual forecasts formed before the dividend announcement. We now show the effect of aggregating individual forecasts into a consensus forecast.

B.1. The Behavior of Consensus Forecasts

The forecasts available to us are averages of individual analysts' forecasts. Since all forecasters do not have the same incentive to re-evaluate and report their forecasts, a given reported consensus forecast might include forecasts that have not been revised for some months. In fact, O'Brien [31] documents that the lag between the date of an individual forecast and its first appearance in the consensus forecasts we use has a mean of thirty-four trading days and a standard deviation of 44.5 trading days. The consensus forecast at t_b can be represented as

$$\overline{FE}_{i,t_b} = \textstyle\sum_{j=0}^{N} \mu^b_{i,t_b-j} FE_{i,t_b-j}, \tag{9}$$

where μ^b_{i,t_b-j} is the proportion of forecasts last updated at $t_b - j$, as of t_b, and N is the furthest back that updates occurred.

Combining equations (8) and (9) yields

$$\overline{FE}_{i,t_b} = \alpha^d \Delta D_i - \alpha^d \nu_i W_i + \bar{\gamma}_{i,t_b} + \varepsilon_{i,t_a}, \tag{10}$$

where

$$\bar{\gamma}_{i,t_b} = \textstyle\sum_{j=0}^{N} \mu^b_{i,t_b-j} \gamma_{i,j}.$$

We can therefore test (4) by estimating the equation

$$\overline{FE}_{i,t_b} = \beta^b_0 + \beta^b_1 \Delta D_i + \xi_{i,t_a}, \tag{11}$$

where

$$\xi_{i,t_b} = -\alpha^d \nu_i W_i + \bar{\gamma}_{i,t_b} + \varepsilon_{i,t_a}.$$

If announcements of unexpected dividend changes convey information leading to updates in expectations, then (10) indicates that we should find

$$\beta_0^b = 0; \quad \beta_1^b = \alpha^d > 0.$$

B.2. Econometric Issues

There are a number of econometric problems associated with estimating equation (11). First, ΔD_i represents the unexpected dividend change. The actual change in the dividend announced at time 0, $\Delta D_i'$, will include some anticipated components of the dividend change. The same events causing these anticipations are also likely to cause revisions in expectations of earnings. This will induce a correlation between $\Delta D_i'$ and ξ_{i,t_b}. Therefore, estimating equation (11) using ordinary least squares and measuring the unexpected dividend change by $\Delta D_i'$ may lead to biased estimates. We address this problem by using the change in equity value in a small window around the dividend announcement, $\Delta S_i'$, as an instrument for $\Delta D_i'$. Because changes in the equity value are a reaction only to unexpected events, by projecting $\Delta D_i'$ onto $\Delta S_i'$ in the first stage of the instrumental-variables procedure, we eliminate the portion of $\Delta D_i'$ that is expected.[5] Because this technique eliminates expected components of dividend changes up to the time just before the announcement is made, our measure of unexpected dividend changes will eliminate expected components not eliminated by the time-series-based measures of unexpected dividend changes used in previous studies.

Second, in equation (11), $\nu_i W_i$ from the error term will be correlated with the right-hand-side variable ΔD_i (and therefore $\Delta D_i'$). This is clear from equation (6). As shown in Appendix A, if ν_i is independent of $\Delta S_i' W_i$, then the instrumental-variables procedure will generate consistent estimates of the coefficients. As discussed in Appendix A, this independence assumption is plausible.

Third, there is the possibility of correlation between the error terms in the cross-section. To the extent that revisions in expectations of earnings are caused by economy-wide events, there will be some correlation between the error terms of those forecasts with overlapping forecast intervals. Our diagnostics indicate that this is not a serious problem. Finally, we find evidence of conditional heteroscedasticity and correct for it using the technique in White [40].

C. Tests of Equation (5)

Rational updating on the part of analysts implies that the information released by the dividend announcement is incorporated quickly into analyst forecasts.

[5] $\Delta S_i'$ is an appropriate instrument for $\Delta D_i'$ only if it is independent of ξ_{i,t_b} in (11). This will not be true if there is a substantial amount of information about expected levels of cash flows, other than that released by the dividend announcement, in the window over which $\Delta S_i'$ is calculated. Appendix B provides a diagnostic that indicates that this is not a problem for our results.

Equation (5) embodies this by requiring that the forecast errors made after the dividend announcement should not be related to the information released by the announcement. As with equation (4), we cannot test (5) directly because our data includes consensus forecasts. The consensus forecasts reported following the announcement of an unexpected change in dividends will likely include some forecasts that have not been revised since before the dividend announcement. We represent the consensus forecast at $t_a + m$ as

$$\overline{FE}_{i,t_a+m} = \sum_{j=0}^{N} \mu_{i,t_b-j}^{m} FE_{i,t_b-j} + \sum_{k=0}^{m} \mu_{i,t_a+k}^{m} FE_{i,t_a+k}. \tag{12}$$

μ_{i,t_b-j}^{m} is the proportion of forecasts last updated at $t_b - j$, as of $t_a + m$.
μ_{i,t_a+k}^{m} is the proportion of forecasts last updated at $t_a + k$, as of $t_a + m$.

Now define μ_i^m as the proportion of forecasts last updated before the dividend announcement, as of period $t_a + m$. Combining (5), (8), and (12) yields consensus forecasts at $t_a + m$, in terms of the unexpected change:

$$\overline{FE}_{i,t_a+m} = \mu_i^m \alpha^d \Delta D_i - \mu_i^m \alpha^d \nu_i W_i + \bar{\gamma}_{i,m} + \bar{\varepsilon}_{i,t_a+m}, \tag{13}$$

where

$$\bar{\gamma}_{i,m} = \sum_{j=0}^{N} \mu_{i,t_b-j}^{m} \gamma_{i,j}; \quad \bar{\varepsilon}_{i,t_a+m} = \mu_i^m \varepsilon_{i,t_a} + \sum_{k=0}^{m} \mu_{i,t_a+k}^{m} \varepsilon_{i,t_a+k}.$$

We cannot observe μ_i^m; however, suppose that we can represent this firm-specific proportion as

$$\mu_i^m = \bar{\mu}^m + \delta_i^m, \tag{14}$$

where $\bar{\mu}^m$ is the cross-sectional average of μ_i^m, and δ_i^m is a stochastic error assumed to have zero mean and to be independent across firms and of W_i, ΔD_i, and $\Delta S_i' W_i$.[6] Combining (13) and (14) yields

$$\begin{aligned}\overline{FE}_{i,t_a+m} &= \bar{\mu}^m \alpha^d \Delta D_i - \mu_i^m \alpha^d \nu_i W_i + \bar{\gamma}_{i,m} + \bar{\varepsilon}_{i,t_a+m} + \delta_i^m \alpha^d \Delta D_i \\ &= \bar{\mu}^m \alpha^d \Delta D_i - \bar{\mu}^m \alpha^d \nu_i W_i + \delta_i^m W_i + \bar{\gamma}_{i,m} + \bar{\varepsilon}_{i,t_a+m}.\end{aligned} \tag{15}$$

Therefore, we test whether forecasters update their forecasts relative to the information embodied in the dividend announcement by estimating

$$\overline{FE}_{i,t_a+m} = \beta_0^m + \beta_1^m \Delta D_i + \xi_{i,t_a+m}, \tag{16}$$

where

$$\xi_{i,t_a+m} = -\bar{\mu}^m \alpha^d \nu_i W_i + \delta_i^m W_i + \bar{\gamma}_{i,m} + \bar{\varepsilon}_{i,t_a+m}.$$

If some forecasters either update or report with a lag, this implies

$$\beta_0^m = 0; \quad \beta_1^m = \bar{\mu}^m \alpha^d > 0 \qquad \text{for all} \quad m.$$

As m, the number of months since the dividend announcement, increases, more forecasters will have reported forecasts updated since t_a, and thus the consensus

[6] We need independence of δ_i^m and $\Delta S_i' W_i$ because we use $\Delta S_i'$ below in the instrumental-variables procedure. It might be argued that, if forecasters see a large unexpected dividend change, they may be more likely to update their forecasts. As discussed below, however, we believe that, in our data set, the delays in updating of the consensus forecast are caused by delays in reporting or by delays in updating by analysts who are not active market participants. We provide evidence for this below.

forecast will include an increasing proportion of forecasts that fully incorporate the information conveyed by the dividend announcement. We should therefore expect the value of β_1^m to decline monotonically with m toward zero.

A gradual decline in the coefficient on the unexpected dividend change is consistent with three explanations. The first is that, while all analysts revise their forecasts following the dividend announcement, some report their revisions with a lag. The second is that, while some analysts revise their forecasts immediately, others only revise them with a lag. However, Eades, Hess, and Kim [10] have shown that there are no abnormal returns subsequent to the announcement of changes in dividends (aside from those associated with the ex-date). Thus, even if the latter explanation is true, only those analysts who revise their forecasts immediately could have had an impact on market prices. The third explanation is that the dividend announcement reduces the forecast error somewhat, and subsequent future quarterly earnings announcements (made in t_a through $t_a + 4$) that are correlated with the dividend announcement reduce them further. However, the Eades, Hess, and Kim results rule out this explanation.[7]

C.1. Econometric Issues

Because of the similarity in the error terms in (11) and (16), the same econometric issues discussed above for estimating (11) are also important for estimating (16). Therefore, we again instrument the dividend change with the change in the stock price around the dividend announcement, $\Delta S_i'$. In Appendix A, we show that, even if ν_i and $\Delta S_i' W_i$ are not independent, any resulting bias will be the same *percentage* for each coefficient estimate (for months t_b through $t_b + 4$). Because we are only examining the *relationship* between the estimated parameters on ΔD, this should not pose a problem.[8]

II. Empirical Implementation of the Model

A. Forecast Data

The forecast data comes from the Investment Brokers Estimate System (I\B\E\S) data base developed by Lynch, Jones, and Ryan. This data base contains summary statistics for forecasts of annual earnings per share made between 1976 and 1984. The individual forecasts are collected on a monthly basis from all major brokerage firms on over 2000 firms listed on the NYSE and AMEX. We define the forecast at t_b to be the consensus forecast for the month before that which includes the dividend announcement. However, because we do not know exactly at what time in the month these forecasts are collected, we define the forecast at t_a to be the consensus forecast for the first month after that which includes the dividend announcement.

B. Dividend Changes

The information on dividend changes and announcement dates comes from the CRSP daily master. As discussed above, we use instrumental variables to eliminate the expected component of dividend changes.

[7] We thank the anonymous referee for help in clarifying these issues.

[8] It is not clear how such a bias would affect estimated standard errors.

C. Changes in Equity Value

The share price data comes from CRSP tapes. We use the change in price per share during a three-day interval starting two days before the announcement (to allow for information leakage) and ending one day after (to allow for full revision). As discussed above (and shown in Appendix B), we perform a diagnostic indicating that this change in equity value is an appropriate instrument for the unexpected dividend change.

D. Inclusion Criteria

We use forecast errors for the first forecast before and the first five forecasts after the dividend announcement. To be included in the sample, an observation must satisfy several criteria.

i. There must be no earnings announcement within a centered twelve-day window surrounding the dividend announcement. Quarterly earnings announcements come from the COMPUSTAT quarterly tape.
ii. There must be no other cash or noncash distributions announced within a centered twelve-day window surrounding the dividend announcement.
iii. The dividend must be a regular cash dividend, as defined by CRSP, and not an initiation of cash dividends.
iv. There must be no other dividend changes three quarters before the dividend change. This requirement makes it more likely that the dividend changes in our sample are unexpected.
v. There must be no relevant *Wall Street Journal* article about the firm in a centered twelve-day window surrounding the dividend announcement.
vi. The forecast in any given month must be for the same fiscal year forecasted just before the dividend change at t_b.
vii. Each month must contain the same set of dividend announcements. This ensures that comparisons of coefficients across months are valid.

There are 781 observations that satisfy these criteria.

III. Results

A. Tests for a Systematic Relationship between Forecast Errors and ΔD

Table I presents summary statistics for the sample. Table II presents results from the instrumental-variables estimation of equation (11) (month t_b). Table III presents results of the first-stage regression of the dividend change ($\Delta D_i'$) on the three-day stock price change ($\Delta S_i'$).[9] This first-stage regression removes the expected component from the change in dividends and corrects for correlation of

[9] The value of the coefficient on the change in stock price is much lower than might be expected for a dividend-price ratio. However, the change in stock price will include important factors besides the unexpected dividend change. This will yield an estimated value of the coefficient on the change in stock price much lower than a dividend-price ratio. As we establish in Appendix A, these additional factors do not invalidate the change in stock price as an instrument for the expected dividend change.

Table I

Summary Statistics: Total Announcements of Dividend Changes Before Elimination Due to Inclusion Criteria: 4766

Number of Observations	781
Mean of $\Delta S'$ [a]	0.203
Standard Deviation of $\Delta S'$ [a]	1.131
Mean of $\Delta D'$ [b]	0.036
Standard Deviation of $\Delta D'$ [b]	0.048
Mean Months from 0 to Fiscal Year End	7.396
Standard Deviation of Months from 0 to Fiscal Year End	1.975

[a] $\Delta S'$ = three-day price change around dividend announcement date (in dollars).
[b] $\Delta D'$ = dividend change (in dollars).

Table II

Regression of Forecast Error on Dividend Change, Instrumental Variables ($\Delta S'$ for $\Delta D'$)

$$\overline{FE}_{i,t_b} = \beta_0^b + \beta_1^b \Delta D_i' + \xi_{i,t_b} \tag{11}$$

Month	Constant	$\Delta D'$	R^2
Month t_b ($N = 781$)			
t_b	−0.5161	12.4690	−0.164
	(0.1182)	(3.0641)	
	(0.0000)	(0.0000)	

$$\overline{FE}_{i,t_a+m} = \beta_0^m + \beta_1^m \Delta D_i' + \xi_{i,t_a+m} \tag{16}$$

Month	Constant	$\Delta D'$	R^2
Months t_a through $t_a + 4$ ($N = 781$)			
t_a	−0.3914	9.0602	−0.150
	(0.1031)	(2.6808)	
	(0.0001)	(0.0007)	
$t_a + 1$	−0.3364	7.4843	−0.126
	(0.0921)	(2.4018)	
	(0.0003)	(0.0018)	
$t_a + 2$	−0.3023	6.6704	−0.126
	(0.0834)	(2.1619)	
	(0.0003)	(0.0020)	
$t_a + 3$	−0.2430	5.2712	−0.107
	(0.0680)	(1.7328)	
	(0.0004)	(0.0024)	
$t_a + 4$	−0.1977	4.3064	−0.093
	(0.0624)	(1.5817)	
	(0.0015)	(0.0065)	

Numbers in parentheses below the parameter estimates are standard errors and p-values. Standard errors are corrected using the White [40] technique.

Table III

First-Stage Regression, Dividend Change on Stock Price Change, Ordinary Least Squares

$$\Delta D_i' = \beta_0 + \beta_1 \Delta S_i' + \zeta_i$$

Month	Constant	$\Delta S'$	R^2
Months t_b through t_a+4 (N = 781)			
All	0.0330	0.0133	0.097
	(0.0022)	(0.0041)	
	(0.0000)	(0.0013)	

Numbers in parentheses below the parameter estimates are standard errors and p-values. Standard errors are corrected using the White [40] technique.

ΔD_i and the error term caused by firm-specific multipliers. The results of the first stage indicate that dividend changes are associated with stock price changes of the same sign.[10]

A.1. Discussion

In estimating equation (11), we want to check that the coefficient on the unexpected change in the dividend is positive. The value for β_1^b of 12.4690 is positive and very significant. These results are strongly supportive of our first hypothesis: forecasts observed before announcements of unexpected changes in dividends exhibit forecast errors that are systematically related to a plausible measure of the information released by the announcement of an unexpected dividend change. Results (not reported) after eliminating outliers are similar.

We also observe a significant negative constant term, indicating that there is typically a positive bias in earnings forecasts unrelated to the unexpected dividend change. This is consistent with the evidence presented by Elton, Gruber, and Gultekin [11] and Fried and Givoly [13] but is not consistent with analysts' forecasts being the mathematical expectation of earnings. In fact, there is no reason to suspect a zero bias, *a priori*, because that would require symmetric loss functions by analysts. Since we are interested only in updates in forecasts around dividend announcements, we take this secular bias as given.[11]

B. Tests for Disappearance of the Systematic Relationship

We now need to examine whether analysts update their expectations following announcements of unexpected dividend changes and whether these updates are

[10] We test whether the presence of cross-sectional correlation of the error terms requires correction of the standard errors. While (11) is a cross-sectional regression, correlation between the error terms can be caused by overlapping periods during which revisions in expectations of earnings occur. By ranking observations by the date of the dividend announcement, the autocorrelations should provide a measure of the correlation of the errors of observations that are most likely to be correlated. Our diagnostic indicates that this correlation is not an important problem. Similar results are obtained for equations (16), (11′), and (16′).

[11] Analysts may not update their forecasts dollar for dollar with their update in expectations if their loss functions are not symmetric. However, if there is no information content in the dividend announcement, then we should not see forecast errors systematically related to the unexpected dividend change.

consistent with rationality. We do this by estimating equation (16) to discover whether the systematic relationship between forecast errors and unexpected dividend changes disappears subsequent to the announcements. Table II presents results for the instrumental-variables estimation of equations (16) (months t_a through $t_a + 4$).

B.1. Discussion

Table II reveals a marked decline in coefficient estimates as we move from t_b to $t_a + 4$. The coefficient estimate on $\Delta D_i'$ declines monotonically from 12.4690 at t_b to 4.3064 at $t_a + 4$. Given that the estimates will be highly correlated, this decline is clearly significant.[12] These results indicate that, following the announcement of an unexpected change in dividends, analysts revise their expectations in a manner consistent with rationality.

Again, we find negative constant terms for months t_a through $t_a + 4$. These terms decline as the forecast time approaches the earnings announcement at T. This is sensible, as any bias that analysts have should disappear as T approaches. Eliminating outliers gives similar results.

IV. Using Equity Value Changes to Test for Information Content

We now provide an alternative test of the hypothesis that announcements of unexpected changes in dividends release information about expected levels of cash flows. Instead of using ΔD_i, the unexpected dividend change, we now use ΔS_i, the change in equity value due to information released by the dividend announcement, to measure the change in expectation due to the announcement, W_i. If unexpected dividend changes convey information about expected cash flows, the change in the stock price around the announcement will reflect the market value of this information.

We provide this alternative test for the following reasons. First, since the coefficient values that arise from this alternative test have an economic interpretation, we can assess the plausibility of our results. Second, we are able to construct control experiments that demonstrate the robustness of our results. Finally, we demonstrate how to apply our methodology in cases where the instrumental-variables technique lacks power.

Suppose that the stock price reaction to the information revealed by the unexpected change in dividends is given by

$$\Delta S_i = (\bar{\omega} + \omega_i) W_i, \qquad (6')$$

where

$\bar{\omega}$ is the cross-sectional average of the multiplier applied by the market to W_i to derive the change in the market value of equity and

ω_i is a firm-specific disturbance around the mean $\bar{\omega}$, assumed to have zero mean and to be i.i.d. across firms and independent of W_i.

[12] Even if the estimates of the coefficients on β_1 for t_b and $t_a + 4$ are uncorrelated, we can reject the hypothesis that the two coefficients are equal. Because of overlapping forecast errors, however, the estimates will be highly correlated. This makes the rejection even stronger.

As in (6), this firm-specific multiplier $\bar{\omega} + \omega_i$ will depend upon firm characteristics and upon the nature of the information being conveyed. For example, if the market interprets the information conveyed as representing a permanent shift in earnings without a change in the discount rate or earnings growth rate, then the multiplier might represent the price-earnings ratio of the firm. If the market interprets the information as representing a more transitory shift, then the multiplier will be much smaller.

Inverting (6′) yields

$$W_i = \alpha^s \Delta S_i - \alpha^s \omega_i W_i, \tag{7'}$$

where $\alpha^s = 1/\bar{\omega}$.

Note that, if $\alpha^s = 0$, then there is no relationship between the change in stock price associated with the announcement and changes in expected levels of future cash flows. The change in stock price then must be due to some other factor (such as bondholder-stockholder wealth transfer.) Derivations similar to those in Section I yield the estimating equations:

$$\overline{FE}_{i,t_b} = \beta_0^b + \beta_1^b \Delta S_i + \xi_{i,t_b}, \tag{11'}$$

where

$$\xi_{i,t_b} = -\alpha^s \omega_i W_i + \bar{\gamma}_{i,t_b} + \varepsilon_{i,t_a};$$

$$\overline{FE}_{i,t_a+m} = \beta_0^m + \beta_1^m \Delta S_i + \xi_{i,t_a+m}, \tag{16'}$$

where

$$\xi_{i,t_a+m} = -\bar{\mu}^m \alpha^s \omega_i W_i + \delta_i^m W_i + \bar{\gamma}_{i,m} + \bar{\varepsilon}_{i,t_a+m}.$$

A. Econometric Issues

The estimation of equations (11′) and (16′) involves econometric issues similar to those discussed for the estimation of (11) and (16).

First, ΔS_i represents the change in stock price occurring as a result of information released by the dividend announcement. As discussed above, we use as a proxy for ΔS_i the change in stock price in a window around 0, $\Delta S_i'$. This change in price will include other information released around 0. This errors-in-variables problem will bias downward OLS estimates of α^s. Second, in equations (11′) and (16′), $\omega_i W_i$ from the error term will be correlated with the right-hand-side variable $\Delta S_i'$. This is clear from equation (6′). This will also bias downward OLS estimates of α^s.

One might be tempted to use the change in dividends, $\Delta D'$, as an instrument for $\Delta S_i'$ to eliminate these biases. However, because the actual change in dividends might have an expected component, it is invalid as an instrument. Instead, we estimate (11′) and (16′) using OLS. It can be shown that, even with the downard bias from OLS, we can perform tests of the hypothesis that $\beta_1 = 0$ because, under this null hypothesis, there is no bias in the estimator.[13] Further,

[13] See Ofer and Siegel [33] for a discussion of this point.

using arguments similar to those in Appendix A, it can be shown that, if $\beta_1 \neq 0$, then any bias will be the same *percentage* for each estimate of the coefficient on ΔS_i. Therefore, we can still test for the significance of the coefficient on ΔS_i at t_b and for the monotonic decline in the coefficient on ΔS_i from t_b to $t_a + 4$ predicted by the model.[14]

To further investigate the robustness of our results, we perform two control experiments. Because the change in stock price might also embody information released about expected levels of cash flows other than that revealed by the dividend announcement, a positive and significant relationship between forecast errors and changes in equity value might be driven by factors other than the dividend announcement. We provide a control experiment below to evaluate the importance of this problem. In particular, we demonstrate that there is no secular relationship between forecast errors and changes in stock prices in windows other than that around the dividend announcement. Finally, we need to test for cross-sectional correlation of the errors and correct for conditional heteroscedasticity.

B. Results

In estimating (11′), we want to check that the coefficient on the change in the stock price is positive. The value for β_1^b from Table IV (month t_b) of 0.1662 is positive and very significant. This verifies that forecast errors for earnings forecasts made before the dividend announcement can be explained by an alternative variable, $\Delta S_i'$, which we use to measure the change in expectations due to information released by the announcement of the unexpected change in dividends. Recall that, while this estimate is downward biased, the tests for significance are still valid.

The coefficient value of 0.1662 represents an average multiplier $\bar{\omega}$ (relating the change in expectation of earnings and the change in stock price) of about six. Taking account of the downward estimation bias, this represents a value somewhat less than six. As long as the bias is not such that the true value of $\bar{\omega}$ is much less than one, our results are consistent with an average multiplier representing a mixture of transitory (ω close to one) and permanent (ω equal to a price-earnings ratio) changes in earnings expectations. These results suggest the economic plausibility of our model.

In estimating (16′), we check for a monotonic decline in the coefficient on the change in stock price from t_b through $t_a + 4$. Table IV reveals a decline on the coefficient from the 0.1662 for t_b to 0.0574 for $t_a + 4$. Results after eliminating outliers are similar.

C. Control Results

We now present the results of two control experiments that we use to eliminate the possibility that our results above are due to a secular relationship between revisions in earnings forecasts and the change in stock price (unrelated to the

[14] Note that we used $\Delta S'$ as an instrument for $\Delta D'$ in the instrumental-variables regressions. Therefore, OLS regressions of the forecast errors on $\Delta S'$ will yield coefficients proportional to those obtained using instrumental-variables regressions.

Table IV

Regression of Forecast Error on Stock Price Change, Ordinary Least Squares

$$\overline{FE}_{i,t_b} = \beta_0^b + \beta_1^b \Delta S_i' + \xi_{i,t_b} \qquad (11')$$

Month	Constant	$\Delta S'$	R^2
Month t_b ($N = 781$)			
t_b	−0.1051	0.1662	0.058
	(0.0285)	(0.0287)	
	(0.0002)	(0.0000)	

$$\overline{FE}_{i,t_a+m} = \beta_0^m + \beta_1^m \Delta S_i' + \xi_{i,t_a+m} \qquad (16')$$

Month	Constant	$\Delta S'$	R^2
Months t_a through $t_a + 4$ ($N = 781$)			
t_a	−0.0928	0.1207	0.039
	(0.0252)	(0.0221)	
	(0.0002)	(0.0000)	
$t_a + 1$	−0.0897	0.0997	0.030
	(0.0238)	(0.0201)	
	(0.0002)	(0.0000)	
$t_a + 2$	−0.0824	0.0889	0.026
	(0.0225)	(0.0188)	
	(0.0002)	(0.0000)	
$t_a + 3$	−0.0692	0.0702	0.019
	(0.0209)	(0.0175)	
	(0.0009)	(0.0000)	
$t_a + 4$	−0.0558	0.0574	0.015
	(0.0194)	(0.0155)	
	(0.0040)	(0.0002)	

Numbers in parentheses below the parameter estimates are standard errors and p-values. Standard errors are corrected using the White [40] technique.

dividend announcement). Our first experiment involves running a regression of the forecast error on the change in stock price between the third and the sixth day after the dividend announcement. Recall that we have removed any dividend announcements for which there was a *Wall Street Journal* story, a regular dividend change, a repurchase, or a noncash distribution during a twelve-day window around the announcement. Because the information embodied in the dividend announcement should be incorporated quickly, this regression will provide an idea of the relationship between forecast errors and the change in stock price during a typical three-day window.

The results from this regression are reported in Table V. We have removed observations for which the ex-day falls within the six days after the dividend announcement because the change in stock price during this period will include the ex-date price drop for these observations. This leaves a sample of 522 observations. The coefficient on the (control) three-day stock price change is −0.0214 and is insignificant. The coefficient on the three-day stock price change around the announcement for this sample is 0.1443 (also reported in Table V). Results for the entire sample are, in fact, similar.

Our second control experiment involves running a regression of the forecast error on the change in stock price in a centered six-day window around the dividend announcement. With no secular relationship between the forecast error

Table V

Regression of Forecast Error on Stock Price Change, Ordinary Least Squares

Regression of Forecast Error on Stock Price Change, Three-Day Control, Ordinary Least Squares

$$\overline{FE}_{i,t_b} = \beta_0^b + \beta_1^b \Delta S_i^* + \xi_{i,t_b}$$

Month	Constant	ΔS^*	R^2
Month t_b ($N = 522$)			
t_b	−0.0618	−0.0214	0.001
	(0.0332)	(0.0281)	
	(0.0625)	(0.4460)	

Regression of Forecast Error on Stock Price Change, Three-Day Stock Price Change Around Announcement, Ordinary Least Squares

$$\overline{FE}_{i,t_b} = \beta_0^b + \beta_1^b \Delta S_i' + \xi_{i,t_b}$$

Month	Constant	$\Delta S'$	R^2
Month t_b ($N = 522$)			
t_b	−0.0927	0.1443	0.050
	(0.0336)	(0.0332)	
	(0.0059)	(0.0000)	

Numbers in parentheses below the parameter estimates are standard errors and p-values. Standard errors are corrected using the White [40] technique. ΔS_i^* is the change in stock price between the third and the sixth day after the dividend announcement.

and the change in stock price, we should obtain a coefficient about half of what we obtained for the three-day window around the dividend announcement because the variance of the six-day window is approximately twice that of the three-day window.[15] If the positive and significant relationship that we detect for the three-day window around the dividend announcement is driven by a secular relationship between forecast errors and the change in stock price, then the coefficients should be about equal.

The results from this regression are reported in Table VI. We have removed observations for which the ex-day falls within the three days after the dividend announcement. This leaves 692 observations. The coefficient on the six-day stock price change is 0.0778, which is about half the value of 0.1490 obtained for the three-day window around the announcement for this sample (also reported in Table VI). Results for the entire sample are similar.

These control experiments indicate that there appears to be no detectable positive and significant secular relationship between forecast errors and changes in stock price. These results also increase our confidence that the results in the paper are not driven by sample selection.

V. Conclusion

In this study, we show that, following the announcement of an unexpected dividend change, analysts revise their forecasts of earnings and they do so in a

[15] In Appendix B, we develop a diagnostic to test for the validity of $\Delta S'$ as an instrument for $\Delta D'$. In that test, we check whether the IV estimate of the coefficient on $\Delta D'$ is the same for three- and six-day windows. The similar diagnostic that we perform here, however, requires that the coefficient on $\Delta S'$ for the six-day window be half of that for the three-day window. The difference in the diagnostic tests arises because the former test arises out of an IV procedure, while the second arises out of an OLS procedure.

Table VI

Regression of Forecast Error on Stock Price Change, Ordinary Least Squares

Regression of Forecast Error on Stock Price Change, Six-Day Control, Ordinary Least Squares

$$\overline{FE}_{i,t_b} = \beta_0^b + \beta_1^b \Delta S_i^0 + \xi_{i,t_b}$$

Month	Constant	ΔS^0	R^2
Month t_b ($N = 692$)			
t_b	−0.1081	0.0778	0.025
	(0.0319)	(0.0234)	
	(0.0007)	(0.0009)	

Regression of Forecast Error on Stock Price Change, Three-Day Stock Price Change Around Announcement, Ordinary Least Squares

$$\overline{FE}_{i,t_b} = \beta_0^b + \beta_1^b \Delta S_i' + \xi_{i,t_b}$$

Month	Constant	$\Delta S'$	R^2
Month t_b ($N = 692$)			
t_b	−0.1061	0.1490	0.050
	(0.0298)	(0.0307)	
	(0.0004)	(0.0000)	

Numbers in parentheses below the parameter estimates are standard errors and p-values. Standard errors are corrected using the White [40] technique. ΔS_i^0 is the change in stock price between the third day before and the third day after the dividend announcement.

manner consistent with rationality. In particular, we document a systematic relationship between forecast errors for forecasts made before dividend announcements and either the size of the unexpected dividend change or the change in stock price surrounding the announcement. Further, this systematic relationship disappears for forecasts made after the dividend announcement. Our results are therefore consistent with the hypothesis that unexpected dividend changes contain information about the firm's expected performance and therefore provide support for dividend-signalling models.

The methodology that we employ uses analyst forecasts as a proxy for market expectations of earnings, as well as changes in stock prices around the dividend announcements. This has an important advantage over previous studies that have tried to infer from price reactions to announcements of changes in financial policies whether these changes cause revisions in market expectations about the performance of the firm. By combining price-reaction data with expectations data, we are able to examine directly whether changes in financial policy convey information about cash flows and whether this information is incorporated by market participants in a manner consistent with rationality.

Our methodology also has several advantages over previous studies that attempt to establish a direct link between changes in corporate financial policy and subsequent performance of the firm. First, analyst forecasts have been shown to outperform the time-series models used by other studies to proxy expected earnings. Second, we are able to examine directly the effect of unexpected dividend changes on expectations of market participants. Finally, while other studies use *ad hoc* models of expected dividends in order to construct unexpected dividends, we use instrumental-variables techniques to eliminate the expected component of dividend changes.

Appendix A: Determining the Bias of the Estimators

This Appendix examines the asymptotic properties of the estimators used in the text. In Section I, we use ΔD_i, the unexpected dividend change, to detect changes in earnings expectations as a result of information released by the unexpected dividend change, W_i. We then derive equations (11) and (16) as the estimating equations. For reasons discussed in the text, we use instrumental variables to estimate (11) and (16). To derive the asymptotic properties of the instrumental-variables estimator, we develop a general case and then apply the results to the estimations in (11) and (16).

Consider the linear model:

$$y = X\beta - \zeta\beta_1 + \varepsilon, \tag{A1}$$

where

y is a $Q \times 1$ vector, where Q is the number of observations,
$X = [\iota, x_1, x_2]$ is a $Q \times 3$ matrix of right-hand-side variables ι, x_1, and x_2 (ι is a $Q \times 1$ vector of 1's),
$\beta = [\beta_0, \beta_1, \beta_2]'$ is the vector of coefficients on X,
ζ is a $Q \times 1$ vector with $\mathrm{E}[\zeta] = 0$, and
ε is a $Q \times 1$ disturbance vector with $\mathrm{E}[\varepsilon] = 0$.

For generality, we allow an additional right-hand-side variable. The results can be extended to more than one additional variable.

Consider the instrumental-variables estimator

$$\beta_{iv} = (Z'X)^{-1}Z'y, \tag{A2}$$

where $Z = [\iota, z_1, x_2]$ is a $Q \times 3$ matrix, with z_1 an instrument for x_1.

We assume that

x_1 and x_2 are independent,
z_1 and x_2 are independent,
z_1 and ε are independent,
x_2 and ε are independent, and
x_2 and ζ are independent.

From (A1), (A2) can be written as

$$\beta_{iv} = \left[\frac{Z'X}{Q}\right]^{-1}\left[\frac{Z'X}{Q}\right]\beta - \left[\frac{Z'X}{Q}\right]^{-1}\left[\frac{Z'\zeta}{Q}\right]\beta_1 + \left[\frac{Z'X}{Q}\right]^{-1}\left[\frac{Z'\varepsilon}{Q}\right]. \tag{A3}$$

Now assume that $\mathrm{plim}(Z'X/Q) = M$ exists. Then, because of the independence assumptions above, we can write

$$\mathrm{plim}\ \beta_{iv} = \beta - M^{-1}\mathrm{plim}\left[\frac{Z'\zeta}{Q}\right]\beta_1. \tag{A4}$$

It can be shown that this implies

$$\mathrm{plim}\ \beta_{0,iv} = \beta_0 + \beta_1\frac{\mathrm{E}[x_1]\mathrm{cov}[z_1, \zeta]}{\mathrm{cov}[x_1, z_1]},$$

$$\text{plim } \beta_{1,iv} = \beta_1 \left[1 - \frac{\text{cov}[z_1,\ \zeta]}{\text{cov}[x_1,\ z_1]} \right], \quad \text{and}$$

$$\text{plim } \beta_{2,iv} = \beta_2. \tag{A5}$$

We now apply these results to derive possible biases in the estimation of equations (11) and (16) by setting

$$x_1 = \Delta D'; \qquad z_1 = \Delta S';$$

$$\Delta D_i' = (\bar{\nu} + \nu_i) W_i^{16}; \qquad \zeta_i = \nu_i W_i. \tag{A6}$$

To examine the bias of the estimators, we need to examine $\text{cov}[z_1,\ \zeta] = \text{cov}[\Delta S',\ \nu W]$ and $\text{cov}[x_1, z_1] = \text{cov}[\Delta D',\ \Delta S']$.

$$\begin{aligned} \text{cov}[\Delta D',\ \Delta S'] &= \text{cov}[\Delta S',\ \bar{\nu} W + \nu W] \\ &= \bar{\nu}\ \text{cov}[\Delta S',\ W] + \text{cov}[\Delta S',\ \nu W]. \end{aligned} \tag{A7}$$

Then,

$$\text{plim } \beta_{1,iv} = \beta_1 \left[1 - \frac{\text{cov}[\Delta S',\ \nu W]}{\bar{\nu}\ \text{cov}[\Delta S',\ W] + \text{cov}[\Delta S',\ \nu W]} \right]. \tag{A8}$$

If ν_i is independent of $\Delta S_i' W_i$, then $\text{cov}[\Delta S',\ \nu W] = 0$ and there is no bias. If $\text{cov}[\Delta S',\ \nu W]$ and $\text{cov}[\Delta S',\ W]$ are positive, then we get an estimate of β_1 biased toward zero in the same proportion for each month in (11) and (16). The bias on the estimate of β_0 will be of opposite sign.

It is very plausible that ν_i is independent of $\Delta S_i' W_i$. By assumption, ν_i and W_i are independent. Therefore, $\Delta S_i' W_i$ and ν_i will be related only if ν_i, the deviation of a firm's multiplier of W_i from the average multiplier $\bar{\nu}_i$, is systematically related to factors that determine the change in the stock price as a function of management's private information. It does not appear, *a priori*, that there should be a systematic relationship, given W_i, between ν_i and $\Delta S_i'$. For a given W_i that the firm wishes to convey, a large positive ν_i will lead, *ceteris paribus*, to a large unexpected positive increase in the dividend, ΔD_i. Whether this large positive ΔD_i is associated with a large positive change in the stock price (relative to the revision W_i), $\Delta S_i'$, is unclear. Consider Bhattacharya's [4] signalling model. If, for example, the high ν_i indicates that the increase in expected earnings is permanent, then $\Delta S_i'$ will also be large and positive. Alternatively, we can think of a high ν_i as indicating that the firm has a great deal of liquidity and therefore needs a large increase in dividends to signal even a transitory increase in earnings. In this case, $\Delta S_i'$ will be relatively small. Finally, if the information being signalled includes an increase in the growth opportunities of the firm (see Myers [29]), then a given W_i will lead to a large $\Delta S_i'$. However, because the firm will need funds for investment, it can signal a given revision W_i with a small dividend. It will then exhibit a negative ν_i.

[16] This equation is not exactly the same as (6) because we replace ΔD_i by $\Delta D_i'$. We do this for notational convenience. None of the results are affected.

Appendix B: A Diagnostic Test of $\Delta S'$ as an Instrument for $\Delta D'$

This Appendix develops a test of whether the positive and significant coefficients obtained in estimating equations (11) and (16) are due to components of $\Delta S_i'$ other than those associated with information released by the dividend announcement. Consider again the linear model given by

$$y = X\beta + \xi, \tag{B1}$$

where the variables are defined as in Appendix A. It can be shown that the probability limit of the instrumental-variables estimator for β_1 is given by

$$\text{plim } \beta_{1,iv} = \beta_1 + \frac{\text{cov}[z_1, \xi]}{\text{cov}[x_1, z_1]}. \tag{B2}$$

Consider the estimation of equation (11). In our problem, $x_1 = \Delta D_i'$ and $z_1 = \Delta S_i'$. Now consider using two different centered windows for $\Delta S_i'$: three days and six days. cov$[\Delta D', \Delta S']$ should remain approximately the same for both windows. Further, cov$[\Delta S', \xi]$ = cov$[\Delta S', \bar{\gamma}]$ (from (11)), where $\bar{\gamma}_{i,t_b}$ represents the average of (non-dividend-related) revisions in expectations about earnings at T between the time the forecast is made and t_a. A nonzero cov$[\Delta S', \bar{\gamma}]$ will arise because the stock price in the centered window will be a function not only of information released by the dividend announcement, but of other information (included in $\bar{\gamma}_{i,t_b}$).

We have cleaned the data for announcements of major events, so it is likely that approximately twice as much non-dividend-related news will arrive in the six-day window as in the three-day window. Therefore, we would expect cov$[\Delta S', \bar{\gamma}]$ for the former window to be approximately twice that for the latter. Therefore, if $\beta_1 = 0$ and the positive coefficient that we observe on $\Delta D_i'$ arises because of a positive cov$[\Delta S', \bar{\gamma}]$ (see (B2)), then we should find the estimate for the six-day window to be approximately twice that for the three-day window.

We have eliminated observations for which there is an ex-date within three days after the dividend announcement. This cleans the sample for ex-date price drops and yields the sample of 692 used in Table VI. Estimating equation (11) using this sample yields a parameter estimate for the coefficient on $\Delta D_i'$ of 10.9782 for the six-day window. This compares with an estimate of 10.8863 for the three-day window. Results after eliminating outliers are similar. It appears, then, that the positive coefficient on $\Delta D_i'$ cannot be explained by the use of $\Delta S_i'$ as an instrument.

REFERENCES

1. J. Aharony and A. Dotan. "The Association between Changes in Dividends and Subsequent Earnings." Tel Aviv University Working Paper, February 1985.
2. J. Aharony and I. Swary. "Quarterly Dividend and Earnings Announcements, and Stockholders' Returns: An Empirical Anslysis." *Journal of Finance* 35 (March 1980), 1–12.
3. P. Asquith and D. W. Mullins. "The Impact of Initiating Dividend Payments on Shareholders' Wealth." *Journal of Business* 56 (January 1983), 77–96.
4. S. Bhattacharya. "Imperfect Information, Dividend Policy and the 'Bird in the Hand' Fallacy." *Bell Journal of Economics and Management Science* 10 (Spring 1979), 259–70.

5. ———. "Nondissipative Signaling Structures and Dividend Policy." *Quarterly Journal of Economics* 95 (February 1980), 1–14.
6. J. A. Brickley. "Shareholder Wealth, Information Signaling and the Specially Designated Dividend: An Empirical Study." *Journal of Financial Economics* 12 (August 1983), 187–209.
7. L. D. Brown and M. S. Rozeff. "The Superiority of Analyst Forecasts as Measures of Expectations: Evidence from Earnings." *Journal of Finance* 33 (March 1978), 1–16.
8. G. Charest. "Dividend Information, Stock Returns and Market Efficiency-II." *Journal of Financial Economics* 6 (July 1978), 297–330.
9. K. M. Eades. "On Dividends as a Signal of Firm Value." *Journal of Financial and Quantitative Analysis* 17 (November 1982), 471–500.
10. ———, P. J. Hess, and E. H. Kim. "Market Rationality and Dividend Announcements." *Journal of Financial Economics* 14 (December 1985), 581–604.
11. E. J. Elton, M. J. Gruber, and M. N. Gultekin. "Professional Expectations: Accuracy and Diagnosis of Errors." *Journal of Financial and Quantitative Analysis* 19 (December 1984), 351–64.
12. E. F. Fama, L. Fisher, M. Jensen, and R. Roll. "The Adjustment of Stock Prices to New Information." *International Economic Review* 10 (February 1969), 1–21.
13. D. Fried and D. Givoly. "Financial Analysts' Forecasts of Earnings: A Better Surrogate for Earnings Expectations." *Journal of Accounting and Economics* 4 (October 1982), 85–107.
14. N. J. Gonedes. "Corporate Signaling, External Accounting, and Capital Market Equilibrium: Evidence on Dividends, Income and Extraordinary Items." *Journal of Accounting Research* 16 (Spring 1978), 26–79.
15. M. S. Grinblatt, R. W. Masulis, and S. Titman. "The Valuation Effects of Stock Splits and Stock Dividends." *Journal of Financial Economics* 13 (December 1984), 461–90.
16. G. Handjinicolaou and A. Kalay. "Wealth Distributions of Changes in Firm Value: An Analysis of Returns to the Bondholders and to the Stockholders around Dividend Announcements." *Journal of Financial Economics* 13 (March 1984), 35–64.
17. M. Harris and A. Raviv. "A Sequential Signalling Model of Convertible Debt Call Policy." *Journal of Finance* 40 (December 1985), 1263–82.
18. P. M. Healy and K. Palepu. "Corporate Financial Decisions and Future Earnings Performance: The Case of Initiating Dividends." M.I.T. Working Paper, May 1986.
19. D. A. Hsieh. "A Heteroscedasticity-Consistent Covariance Matrix Estimator for Time Series Regressions." *Journal of Econometrics* 22 (August 1983), 291–90.
20. G. Huberman. "External Financing and Liquidity." *Journal of Finance* 39 (July 1984), 895–908.
21. K. John and J. Williams. "Dividends, Dilution, and Taxes: A Signalling Equilibrium." *Journal of Finance* 40 (September 1985), 1053–70.
22. A. Kane, Y. Lee, and A. Marcus. "Earnings and Dividend Announcements: Is There a Corroboration Effect?" *Journal of Finance* 39 (September 1984), 1091–99.
23. P. M. Laub. "On the Informational Content of Dividends." *Journal of Business* 49 (January 1976), 73–80.
24. H. Leland and D. Pyle. "Information Asymmetries, Financial Structure and Financial Intermediaries." *Journal of Finance* 32 (May 1977), 371–87.
25. T. Lys and S. Sivaramakrishnan. "Earnings Expectations and Capital Restructuring: The Case of Equity for Debt Swaps." Northwestern University Working Paper, December 1986.
26. R. W. Masulis. "The Effects of Capital Structure Change on Security Prices." *Journal of Financial Economics* 8 (June 1980), 138–77.
27. W. H. Mikkelson. "Convertible Calls and Security Returns." *Journal of Financial Economics* 9 (September 1981), 237–64.
28. M. Miller and K. Rock. "Dividend Policy under Asymmetric Information." *Journal of Finance* 40 (September 1985), 1031–52.
29. S. C. Myers. "The Determinants of Corporate Borrowing." *Journal of Financial Economics* 5 (November 1977), 147–75.
30. ——— and N. S. Majluf. "Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have." *Journal of Financial Economics* 13 (June 1984), 187–222.
31. P. C. O'Brien. "Analyst's Forecasts as Earnings Expectations." M.I.T. Sloan School of Management Working Paper, March 1986.

32. A. Ofer and A. Natarajan. "Convertible Call Policies: An Empirical Analysis of An Information Signalling Hypothesis." Forthcoming, *Journal of Financial Economics.*
33. A. Ofer, D. Siegel, and R. Israel. "On the Use of Changes in Equity Value as a Measure of the Value of Information." Northwestern University Finance Department Working Paper No. 30, 1987.
34. A. Ofer and A. Thakor. "A Theory of Stock Price Responses to Alternative Corporate Cash Disbursement Methods: Stock Repurchases and Dividends." *Journal of Finance* 42 (June 1987), 365–94.
35. R. R. Pettit. "Dividend Announcements, Security Performance, and Capital Market Efficiency." *Journal of Finance* 27 (December 1972), 993–1007.
36. ———. "The Impact of Dividends and Earnings Announcements: A Reconciliation." *Journal of Business* 49 (January 1976), 86–96.
37. S. A. Ross. "The Determination of Financial Structure: The Incentive-Signalling Approach." *Bell Journal of Economics and Mangement Science* 8 (Spring 1977), 23–40.
38. T. Vermaelen. "Common Stock Repurchases and Market Signaling." *Journal of Financial Economics* 9 (June 1981), 138–83.
39. R. Watts. "The Information Content of Dividends." *Journal of Business* 46 (April 1973), 191–211.
40. H. White. "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity." *Econometrica* 48 (May 1980), 817–38.