Dividend Change Announcements and Structural Change

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Abstract

The primary contention of the dividend signaling hypothesis is that firms that unexpectedly alter their dividend payments provide the market with a signal of management's expectations of future performance of the firm. In this context, the signaling hypothesis presupposes a connection between the dividend change and the future performance of the firm. The purpose of this study is to investigate this relationship using structural change methodology that adjusts for heteroscedasticity when appropriate. The evidence is consistent with a change in earnings structure following an unexpected dividend change announcement. For firms exhibiting structural change, the most frequent case is a statistically significant change in the earnings growth rate. In addition, structural change is most apparent when unfavorable information is conveyed.

Introduction

The role of dividend policy in determining the value of a corporation long has been a subject of research and discussion in the finance literature. Even the most outspoken proponents of the irrelevance of dividends in stock valuation have made the observation that dividend change announcements often are accompanied by abnormal stock price performance. Although supporters of dividend relevance would interpret this fact as evidence that investors have a preference for higher dividends, believers of the irrelevance of dividends indicate that the reason for the abnormal stock price performance around dividend change announcement dates is the information content of the announcement. As expressed by Miller and Modigliani (1961), the information content approach indicates that investors may "interpret a change in the dividend rate as a change in management's views of future profit prospects for the firm." (1961, p. 430). Thus, the dividend changes may convey information about management's forecasts of future performance of the firm and represent a signal about the firm's future earnings potential. In this sense, the dividend change announcement is assumed to signal a major change in the firm's earnings structure.

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This study examines the underlying assumption that a dividend change announcement indicates a major shift in the firm's earnings structure by examining the firm's performance prior to and following the signal. The empirical evidence is consistent with a structural change subsequent to unexpected dividend announcements. The analysis also examines the nature of the change in structure and the effects on the firm's systematic risk.

Most of the existing literature in the dividend signaling area can be classified into two broad categories. Several studies (Bar-Yosef and Huffman, 1986; Bhattacharya, 1979 and 1980; John and Williams, 1985; Miller and Rock, 1985) have examined theoretically the mechanism by which dividends serve as a signal. Also, many empirical studies have concentrated on measuring the market's reaction to the dividend change announcement and establishing the existence of the signaling effect (Aharony and Swary, 1980; Asquith and Mullins, 1983 and 1986; Charest, 1978; Divecha and Morse, 1983; Eades, 1982; Kalay, 1980; Kane, Lee, and Marcus, 1984; Woolridge, 1982). In general, the empirical evidence supports the use of dividends as signaling mechanisms--the market reacts positively when the dividends convey favorable information and negatively when unfavorable information is conveyed. A common assumption in all previous studies is the relationship between the dividend signal and the subsequent performance of the firm. The market reaction to the dividend change, in a direction consistent with the direction of the change, has been interpreted as evidence that the market reacts to the expectations of altered future performance signaled by the dividend change. In addition, recent studies have examined the relationship between the magnitude of the market reaction and the perceived cost of the signal (Ghosh and Woolridge, 1988), the dividend yield (Fehrs, Benesh, and Peterson, 1988), and firm size (Eddy and Seifert, 1988). These studies, for the most part, have ignored the question of the reliability of dividend change announcements as signals. If dividend changes are reliable signals of the firm's future performance, the market's reaction to the dividend signals should be justified by changes in the actual performance of the firm subsequent to the signal. An excellent measure of the firm's performance is earnings per share. If dividend signals are to be considered reliable, their information content should reflect expectations of future earnings performance, and these expectations should be justified by the actual earnings stream of the firm subsequent to the signal.

Few studies have examined the relationship between dividend changes and earnings. Watts (1973) examines the dividend-earnings relationship using annual data. He finds that forecasts of future earnings are improved only marginally when current dividends are included in the forecasting model. He finds a weak positive relationship between unexpected dividend changes and future earnings changes and concludes that the information content of dividends can be only trivial. Gonedes (1978) also is unable to find an economically significant relationship between dividends and subsequent earnings of the firm. Brickley (1983) finds evidence of higher earnings following specially designated dividends. Born, Moser, and Officer (1987-1988) study the long-term performance of firms with dividend policy changes and find inconsistent evidence, as some types of dividend policy changes are followed by unexpected performance consistent with the direction of the change, while other types of dividend change announcements do not result in improved performance. Kane, Lee, and Marcus (1984) examine the corroboration effect between earnings announcements and dividend announcements. They find that the market reaction is stronger when the dividend announcement and the contemporaneous earnings announcement contain similar information. Finally, Ofer and Siegel (1987) find that analysts' earnings forecasts are revised following unexpected dividend change announcements by an amount proportional to the magnitude of the dividend change and observe a positive relationship between unexpected dividends and subsequent earnings in the announcement year. The existing studies provide mixed evidence on the relationship between dividend signals and subsequent performance of the firm.

This study provides additional evidence on the reliability of dividend change announcements as predictors of future performance. The accuracy of the assumption that a dividend change announcement indicates a major shift in the firm's earnings structure is tested by examining the firm's performance prior to and following the signal. The major tool of the study is the application of the structural change test methodology to this interesting question. In this respect, the study differs greatly from the existing literature in the area.

The Dividend Expectations Model

The primary contention of the dividend signaling hypothesis is that firms that unexpectedly alter their dividend payments provide the market with a signal of management's expectations of future performance of the firm, resulting in a readjustment of the market's valuation of the firm. In this context, the signaling hypothesis presupposes a connection between the dividend change announcements and the future performance of the firm. This paper investigates the relationship between dividend change announcements and the future performance of the underlying firms (measured by earnings per share (EPS), excluding extraordinary items and discontinued operations).

Dividend announcements that contain information are those that deviate from market expectations. Several previous studies (Aharony and Swary, 1980; Charest, 1978; Divecha and Morse, 1983; Eades, 1982; Kane, Lee, and Marcus, 1984; and others] have used the naive expectations or the Martingale model (i.e., expected dividends in this period are the realized dividends in the previous period). This approach may be inadequate because a portion or the entire amount of some changes may be expected by the market and, thus, dividend announcements do not contain any new information. Some changes that are expected by the market never are substantiated, in which case the absence of the change may convey some new information. In this study, *Value Line's* estimates of next period's dividends are used as the proxy for the market expectations, an approach consistent with Woolridge (1982). *Value Line* is a widely read investment periodical recognized by many academicians as well as investors for its ability to estimate future dividends and earnings of individual firms. In addition, it provides timely and accurate forecasts about the future performance of industry groups and publishing investment advice (Brown and Rozeff, 1978; Fried and Givoly, 1982; Givoly and Lakonishok, 1984). Thus, it is reasonable to assume *Value Line's* dividend forecast, made immediately prior to a company's dividend announcement, is a good proxy for the market expectation of the dividend.

Because the *Value Line* forecast is reported in the summary and index section as an estimate of the dividends per share for the next twelve months, the implied quarterly forecast can be extracted by dividing the twelve month forecast by four, assuming that the dividends are expected to be paid in a steady stream. Consequently, dividend announcements that contain information are those that deviate from the *Value Line* forecast, where the deviations are stated in percentage terms. The dividend signal (unexpected dividend change) is measured by:

$$\Delta D_i = \frac{D_{ti} - E_{t-\varepsilon}[D_{ti}]}{E_{t-\varepsilon}[D_{ti}]}$$

where:

$E_{t-\varepsilon}[D_{ti}]$ = the market expectation of the quarterly dividend for company i at time t, formed immediately prior to the dividend announcement; and

ε = the time between the last issue of the *Value Line* estimate and the dividend announcement.

Tests for Structural Change

To detect evidence of structural change, the structure of earnings in the eight quarters prior to the dividend change announcement is compared to the earnings structure in the eight quarters following the change. The earnings structure for each firm is estimated by the following model:

(1) $EPS_t = a_0 + a_1 t + a_2 E_{mt} + z$

where:

EPS_t	= earnings per share for each firm at time t.
t	= time counter.
E_{mt}	= earnings for the S&P 500 index at time t.
z	= the residual of the regression in equation (1).

This model is a combination of the two earnings expectation models developed by Ezzell (1974) and is also similar to the earnings model developed by Ball and Brown (1967, 1968). The model implies earnings of each firm are affected by two major factors: a time trend and the earnings of the market portfolio during the same quarter, proxied by the S&P 500 index.[1] EPS_t data are obtained from the quarterly Compustat data tapes,[2] and E_{mt} data are extracted from the monthly supplements of *Standard & Poor's Analysts' Handbook.*

The purpose of this study is to examine the reliability of dividend signals by determining if a change in earnings structure has occurred following the dividend announcement. A change in earnings structure is indicated by significant shifts in the regression coefficients. A change in structure in the same direction as the dividend change is consistent with the reliability of the dividend announcement. On the other hand, the absence of a significant change indicates lack of evidence in support of the signal's reliability. A Chow type test is used to determine significance, and a nonparametric sign test is used to examine consistency of direction of the change.

The Chow test methodology consists of a joint test of the equality of the slope and intercept parameters of the regressions before and after the event hypothesized to cause a structural change. For the two period comparison, as described by Johnston (1984), the unrestricted form of the model, allowing for different regression coefficients over the two time periods, can be expressed compactly as:

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[1] EPS_t and E_{mt} are synchronized by matching the earnings of each sample firm for the eight quarters preceding and following the dividend signal with the EPS of the S&P 500 index for the same calendar quarters.

[2] In case of extreme observations, the EPS were verified by examining *Moody's Handbook of Common Stocks.*

$$(2)\quad \begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} = \begin{bmatrix} X_1 & O \\ O & X_2 \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \end{bmatrix}$$

where:

Y_1 and Y_2	= n x 1 vectors of dependent variables for periods one and two;
X_1 and X_2	= n_1 x k and n_2 x k block diagonal data matrices;
β_1 and β_2	= the k x 1 vectors of parameter estimates; and
e_1 and e_2	= random error vectors of dimensions n_1 x 1 and n_2 x 1, with each element distributed independently and normally with a mean of zero and variance of σ^2.

On the other hand, the restricted form of the model, based on the null hypothesis of no structural change which implies no difference in regression parameters over the two time periods, can be stated compactly as:

$$(3)\quad \begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} = \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} \begin{bmatrix} \beta \end{bmatrix} + \begin{bmatrix} e \end{bmatrix}$$

where:

Y_1, Y_2, X_1, and X_2 are the same as above;
β = the vector of the joint regression parameters with dimension of k x 1; and
e = the random N x 1 error vector with $N = n_1 + n_2$.

The parameter estimates for equations (2) and (3) are obtained via ordinary least squares (OLS) regression. The null hypothesis is:

$$(4)\ H_0 : \beta_1 = \beta_2$$

The traditional form of the Chow test to examine the equality of the regression coefficients in the two time periods is equivalent to:

$$(5)\quad F = \frac{(\hat{e}'\hat{e} - \hat{e}_1'\hat{e}_1 - \hat{e}_2'\hat{e}_2)/k}{(\hat{e}_1'\hat{e}_1 + \hat{e}_2'\hat{e}_2)/(n_1 + n_2 - 2k)} \sim F(k, N - 2k)$$

where:

$\hat{e}$, $\hat{e}_1$, and $\hat{e}_2$ = the regression residuals for equations (2) and (3).

Because the traditional form of the Chow test requires the equality of the variances of the error vectors e_1 and e_2, the use of the traditional form of the test for structural change may be inappropriate. As explained by Toyoda (1974), Jayatissa (1977), Schmidt and Sickles (1977), Conerly and Mansfield (1988), and others, if the error variances are not equal, the power of the test is affected, and the nominal level of significance is not maintained. Therefore, a necessary preliminary step for any test for structural change is the investigation of the existence of unequal error variances (heteroscedasticity). In the model presented in equation (1), z denotes the unexplained error term. Changes in the variability of this error term over the pre- and postdividend announcement periods are the possible source of heteroscedasticity.

The equality of the error variances of the two regressions can be tested by computing the following ratio:

$$(6)\quad F = \frac{MSE_L}{MSE_S} \sim F(n_L - k, n_S - k)$$

where:

MSE_L = the larger mean square error of the two regression estimates;
MSE_S = the smaller mean square error of the two regression estimates;
n_L = the number of observations in the sample associated with MSE_L; and
n_S = the number of observations in the sample associated with MSE_S.

Although there is much discussion in the statistics literature about the proper procedure for a test for structural change in the presence of heteroscedasticity, a recent contribution by Conerly and Mansfield (1988) seems to provide the most powerful test with minimum deviation from the nominal significance level. The test statistic developed by Conerly and Mansfield can be expressed as:

$$(7)\quad C = \frac{(\hat{e}'\hat{e} - \hat{e}_1'\hat{e}_1 - \hat{e}_2'\hat{e}_2)/k}{(1-\bar{\lambda})\, S_1^2 + \bar{\lambda}\, S_2^2}$$

where C follows an approximate F-distribution with degrees of freedom:

$$f_1 = \{k[(1-\bar{\lambda})\, s_1^2 + \bar{\lambda}\, s_2^2]\}^2 / \sum_{i=1}^{k} \{(1-\lambda_i)\, s_1^2 + \lambda_i\, s_2^2\}^2$$

$$f_2 = \frac{[(1-\bar{\lambda})\, s_1^2 + \bar{\lambda}\, s_2^2]^2}{\{[(1-\bar{\lambda})\, s_1^2]^2 / (n_1-k) + [\bar{\lambda}\, s_2^2]^2 / (n_2-k)\}}$$

$\bar{\lambda}$ = the mean of λ_i, the eigenvalues of $X_1'X_1(X_1'X_1 + X_2'X_2)^{-1}$ with X_1 and X_2 as defined earlier.

A complete test for structural change requires a follow-up analysis to determine the source of the structural change. In many cases, it is important to determine whether the significant change in structure is due to a shift in the intercept or a change in the slope coefficients. Thus, in those cases where a significant structural change in earnings per share is established, it is necessary to determine the nature of the change. The follow-up analysis is conducted by estimating the earnings structure for each firm in the sample using the same basic relationship in equation (1) with the addition of a dummy variable for the time period and the dummy interaction terms. Thus, it is necessary to estimate the coefficients of the regression equation:

(8) $EPS_t = a_0 + a_1 t + a_2 E_{mt} + a_3 D + a_4(D)(t) + a_5(D)(E_{mt}) + u_t$

where:

t = a time counter;
E_{mt} = the earnings per share for the S&P 500 index;
D = a dummy variable taking on the value of 0 when $t \leq 8$ and 1 when $t > 8$; and
u_t = the residual term.

The coefficient estimates for equation (8) are obtained by the general linear model (GLM) technique. A significant estimate for a_3 implies a significant change in the level of EPS, while a significant estimate for a_4 may be interpreted as a significant change in the growth of EPS. A statistically significant value of a_5

implies a significant change in the relationship between the firm and market EPS.

To determine if there is a structural change at the time of the dividend announcement requires an additional modification of the methodology. Because the dividend announcement occurs between quarters eight and nine, to center the right-hand side variables in equation (8), the mean values of the t and E_{mt} variables are subtracted from each observation of those variables. This modification artificially moves the intercept to the mean value of the right-hand side variables without altering the slope coefficients. Thus, the significance of the a_3 coefficient measures the significance of the change in the earnings structure due to the shift in the intercept between quarters eight and nine, where the dividend change is announced.[3]

Data and Empirical Results

The sample for this study consists of all dividend announcements for the January 1979 to December 1983 period that satisfy the following criteria:

(1) The firm is covered by *Value Line* during the study period.
(2) Complete daily returns are available on the CRSP tapes during the study period.
(3) Complete earnings data are available on the Compustat tapes.
(4) No other significant announcements have been made by the firm during the ten days surrounding the dividend announcement.
(5) The actual dividend announcement deviated by 10 percent or more from the *Value Line* forecast.[4]
(6) The firm made no other significant dividend change announcements within the two years (500 business days) surrounding the announcement.[5]

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[3]The dummy variable technique may be inadequate in the presence of heteroscedasticity.

[4]The 10 percent filter is used to exclude trivial information to which the market is unlikely to react. Also, small deviations are likely to contain a lot of noise. Although somewhat arbitrary, this 10 percent filter corresponds to Divecha and Morse's (1983) observation for firms that announce dividend increases of 10 percent or less, the market reaction is insignificant.

[5]This screen is imposed to assure that the firms in the sample were not involved in frequent dividend changes, each of which can be viewed as a structure-changing event.

These screens produce 114 observations, 45 dividends exceeding expectations and 69 dividends below expectations. Table 1 provides summary measures of the sample of firms with unexpected dividend changes. In order to validate the sample selection criteria, the residual returns around the dividend announcement dates were examined using standard market model event study methodology. Table 2 summarizes the average residuals and cumulative average residuals (CAR) around the announcement date. The CARs are positive and significant for unexpected dividend increases and negative and significant for unexpected dividend reductions, consistent with previous studies.

As explained above, the structure of earnings per share for the firms in the sample is estimated by equation (1). The hypothesized relationship in equation (1) seems to explain the structure of earnings per share relatively well in a majority of the cases, as reflected by significant F-ratios.[6]

Table 3 reports the outcome of the test for the presence of heteroscedasticity, described in equation (6) (column two), the appropriate F statistic described in equations (5) or (7) (column three), the t ratios and p values for the coefficients of the D, (D)(t), and (D)(E_m) variables when structural change is present (columns four through nine), and the type of announcement--0 for positive unexpected dividends and 1 for negative unexpected dividends (column ten). The analysis indicates that heteroscedasticity was present in 31 of the 114 observations.[7] Of the 114 observations, 33 displayed evidence of structural change demonstrated by F ratios significant at the 90 percent confidence level. Finally, of the 33 significant changes in structure, 13 were due to a significant shift in the intercept, 19 were the result of a significant change in a_4, the slope parameter of the time trend, six were due to a significant change in a_5, the

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[6]Although the hypothesized model is a relatively accurate representation of the sample firms' earnings, the variability in the goodness of the fit is evident from the wide range in the observations of R^2 coefficients and F ratios. The summary measures for the regressions are available from the authors upon request.

[7]Note that Eades (1982) has demonstrated a negative relationship between the dividend yield and the riskiness of the firm's returns, both in terms of systematic and total risk, as well as establishing a relationship between relative signal strength and the variance of returns. The observed heteroscedasticity may be due to the structural change in earnings resulting from a relationship between dividend changes and earnings variance. An observation of Table 1, however, reveals that in only seven cases is both structural change and heteroscedasticity present. A possible explanation is that some firms may signal changes in earnings structure, while others signal changes in riskiness (variance) of the earnings stream. Although this is a view shared by Eades, further research is necessary to examine this issue thoroughly.

parameter of the relationship with market earnings, and in eight cases both the intercept and at least one of the slope parameters shifted significantly.

In order to examine more closely the relationship between dividend signals and structural change in earnings, the hypothesis that the proportion of significant structural changes is not different than would be expected under random occurrence is examined. The null hypothesis is expressed as:

(9) $H_0 : p_0 = .10$

where p_0 represents the population proportion.[8] The test statistic is:

(10) $$T_u = np_0 + Z_\alpha(np_0(1-p_0))^{1/2}$$

n represents sample size, and Z_α is the 1-α quintile from the standard normal distribution, as described in Iman and Conover (1983). For the sample in this study, the critical value with a stringent significance level (α) of .01 is 21.35. Because the observed outcome of 33 significant changes far exceeds the upper critical value of 21.35, the outcome is consistent with a systematic relationship between dividend signals and earnings structure.

Finally, the follow-up methodology described in equation (8) is extended to the whole sample of 114 observations, and the signs of the coefficients of the dummy and dummy interaction variables are observed. Table 4 presents a summary of the observations. The significance of the relationship between the dividend signals and the signs of the coefficients of the dummy and dummy interaction terms is examined using a sign test.

The sign test is based on the assumption that if the relationship between the dividend signal and earnings structure is arbitrary, one would expect an equal probability for positive and negative shifts in the regression coefficients. Alternatively stated, under the null hypothesis of a nonsystematic relationship between dividend changes and earnings structure, an equal number of positive and negative signs would be expected on the coefficients a_3, a_4, and a_5 for positive and negative signals, implying a .5 probability of observing a positive or negative coefficient.

Using the large sample normal approximation with the correction for continuity, the test statistic provided by Gibbons (1976) is:

(11) $$Z = [S_+ - 0.5 - 0.5(n)] / 0.5(n)^{1/2}$$

[8]Because the significance level of the test for structural change was set at .10, this would imply statistically significant change would be expected in 10 percent of the observations if the relationship were random.

where:

S_+ = the number of positive signs in the case of positive signals and the number of negative signs in the case of negative signals; and

(n) = the number of total observations (45 for positive signals and 69 for negative signals).

Table 5 provides a summary of the tests of significance. For the positive signals (unexpected dividend increases), the null hypotheses of equal probability of positive and negative coefficients for the dummy and dummy interaction variables are not rejected. Thus, there is not sufficient evidence to suggest a systematic relationship between positive signals and subsequent changes in earnings structure. The sign test results, however, suggest that unexpected dividend reductions are related positively to subsequent changes in the intercept and the coefficient of the time counter.[9] This finding is consistent with a downward shift in earnings per share in the near term and a reduction in the earnings growth rate in the intermediate term following the dividend reduction. In other words, the shift in the intercept can be interpreted as the change in the level of earnings per share, while the change in the coefficient of the time counter measures the change in the earnings growth rate. The hypothesis test results also indicate a negative relationship between the negative signals and the coefficient of E_{mt}. This observation may indicate a strengthening relationship with market earnings for dividend-reducing firms, pointing to possible increase in the systematic risk. To explore this possibility further, the systematic risk of the sample firms were examined for the pre- and postannouncement periods. The preannouncement betas were estimated for the 100 days starting 110 days prior to the announcement, and the postannouncement betas were estimated over the 100 days starting ten days after the announcement. The average preannouncement β was 0.8498, and the average postannouncement β was 0.8423. The t-test for matched pairs resulted in a test statistic of 0.1947, which is not statistically significant, indicating no significant change in systematic risk around the dividend change announcement.[10]

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[9]The sign test may overstate the count by only observing the signs of the regression coefficients without regard to their significance. This should not produce a bias in either direction, however, as the null hypothesis is that of equal probabilities of observing each sign. The procedure employed does not increase the likelihood of observing either sign.

[10]Note that the systematic risk was analyzed over the 100 days surrounding the 20 day announcement window. The findings do not rule out changes in systematic risk over longer time horizons.

The results are consistent with previous research--numerous event studies have found evidence of a stronger market reaction to dividend reductions compared to dividend increases. It appears that investors assign more credence to the information content of negative dividend signals in comparison to positive dividend signals, because negative signals are more likely to be structure-changing events for the announcing firms and the change in structure is in a direction consistent with the direction of the announcement.

Conclusions

The results in this paper are consistent with previous research--a weak link between dividend signals and subsequent earnings performance is found. This study differs from previous studies in its methodology and its focus. A Chow type methodology adjusted for heteroscedasticity when appropriate is used to examine the relationship between dividend changes and earnings performance. The empirical evidence indicates that although there is a relationship between dividend changes and earnings structure for some firms, the relationship is statistically significant for less than a third of the observations (33 of 114). For firms exhibiting changes in structure, the most frequent change is either a statistically significant change in the intercept coefficient, interpreted as a change in the level of earnings, or a change in the coefficient of the time variable, interpreted as a change in the earnings growth rate. In addition, changes in structure are most apparent when unfavorable information is conveyed.

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Table 1
Sample Summary for the Unexpected Dividend Announcements

Range of Dividend Percent Change	Number of Dividend Increases	Number of Dividend Decreases
1.00+	9	2
.75 - .999	1	3
.50 - .749	1	6
.25 - .499	7	7
.10 - .249	27	51
TOTAL	45	69
MEAN	.4537	-.2774
STD DEV	.6571	.4001
QUINTILES		
10 percent	.1027	-.1033
25 percent	.1187	-.1111
50 percent	.1875	-.1288
75 percent	.4722	-.2615
90 percent	1.0000	-.6538

Table 2
Summary of Residual Returns Around Dividend Announcements

	Dividend Increases		Dividend Decreases	
Day	AR	CAR	AR	CAR
-1	0.00083	0.00083	-0.00285*	-0.00285
0	0.00435**	0.00518*	-0.00208	-0.00493**
+1	0.00188	0.00706**	-0.00410**	-0.00903**

*Significant at the .10 level
**Significant at the .05 level

Table 3
Summary of Structural Change Tests

CUSIP	F RATIO EQU (6)	F RATIO EQU (4)	T RATIO $H_0{:}a_3=0$	P VALUE	T RATIO $H_0{:}a_4=0$	P VALUE	T RATIO $H_0{:}a_5=0$	P VALUE	TYPE
002440	46.2647**	0.5809							1
002824	10.9761**	1.4810							1
004626	5.4706**	1.1113							1
008140	2.6205	3.6215*	-3.15	0.0104	-1.78	0.1061	-2.63	0.0251	1
019645	34.2822**	5.3417*	1.94	0.0805	-3.66	0.0044	-1.58	0.1460	0
022249	3.1482	4.5777*	-1.27	0.2340	-2.55	0.0288	-1.74	0.1122	1
031105	1.2212	2.9177*	-2.58	0.0273	-0.46	0.6580	1.31	0.2192	1
037411	1.2522	0.1971							0
049267	1.1822	1.4221							0
059815	5.5292**	4.2422*	-2.77	0.0199	2.78	0.0194	1.39	0.1958	1
071892	1.3277	1.3452							1
077851	1.4716	0.7426							1
081437	3.7328	1.4844							0
087509	241.6782**	0.1391							1
115223	8.1092**	1.3354							1
115885	2.5174	3.0567*	-0.52	0.6176	2.08	0.0644	1.62	0.1373	1
126149	1.1630	1.6103							1
143898	2.8365	1.7565							1
149123	2.4160	4.8128*	-1.64	0.1327	-3.35	0.0074	1.14	0.2794	1
158525	5.3348**	4.3804*	0.89	0.3931	2.55	0.0287	-0.61	0.5573	1

Table 3 (continued)
Summary of Structural Change Tests

CUSIP	F RATIO EQU (6)	F RATIO EQU (4)	T RATIO $H_0{:}a_3=0$	P VALUE	T RATIO $H_0{:}a_4=0$	P VALUE	T RATIO $H_0{:}a_5=0$	P VALUE	TYPE
181396	105.4892**	2.1491							0
185896	1.1652	0.3420							0
189873	2.0688	3.0094*	1.16	0.2747	-1.39	0.1936	1.29	0.2273	0
193558	1.5946	3.2851*	-1.90	0.0864	-0.33	0.7460	-1.42	0.1873	1
201723	1.0160	0.7417							1
203417	7.4217**	2.1797							0
209615	3.2312	1.6868							1
219327	5.1263**	0.1976							0
220291	1.1351	3.9793*	-1.88	0.0898	1.89	0.0887	-0.67	0.5209	1
227478	1.8806	1.8740							1
229669	9.7617**	0.8391							0
229890	2.1439	4.6421*	-3.35	0.0073	0.09	0.9308	2.41	0.0364	1
231561	9.6820**	0.4181							0
238107	1.8917	3.7381*	-2.66	0.0240	-0.58	0.5751	0.76	0.4676	1
244199	1.1338	0.3589							0
252165	4.2647	1.0081							1
266228	1.6287	2.0492							0
276461	2.3436	1.5190							0
278058	7.5544**	0.4214							1
284443	2.4777	3.4625*	-0.83	0.4269	-2.78	0.0196	0.49	0.6352	0

Table 3 (continued)
Summary of Structural Change Tests

CUSIP	F RATIO EQU (6)	F RATIO EQU (4)	T RATIO $H_0{:}a_3=0$	P VALUE	T RATIO $H_0{:}a_4=0$	P VALUE	T RATIO $H_0{:}a_5=0$	P VALUE	TYPE
302491	1.3591	1.9435							1
302846	1.4378	0.4479							1
313225	1.6774	1.6613							0
337659	1.6707	7.5229*	-1.80	0.1017	-3.58	0.0050	-0.62	0.5469	0
369352	1.0673	0.6463							0
369353	4.6577	1.3159							0
381317	1.0141	1.5814							1
383492	870.4187**	0.8394							0
400181	19.7067**	1.0125							0
423452	3.3734	2.1838							1
427866	3.2037	0.9140							0
429812	1.6123	5.1060*	-3.25	0.0087	2.77	0.0197	-1.63	0.1332	0
444356	1.0602	2.2233							0
444859	2.8696	1.9972							0
456866	7.8546**	0.4118							0
458702	16.3786**	3.2113							0
459101	4.9639	2.0939							1
478160	3.7486	2.8074*	0.27	0.7906	1.68	0.1243	0.93	0.3763	1
499040	2.3947	0.9011							1
500602	1.8758	0.2335							0

Table 3 (continued)
Summary of Structural Change Tests

CUSIP	F RATIO EQU (6)	F RATIO EQU (4)	T RATIO H_0:a_3=0	P VALUE	T RATIO H_0:a_4=0	P VALUE	T RATIO H_0:a_5=0	P VALUE	TYPE
501566	11.7843**	3.6421*	-0.68	0.5136	1.72	0.1166	1.53	0.1582	0
520786	22.1864**	1.2815							1
534187	2.6126	9.1739*	1.09	0.3010	-4.54	0.0011	-4.01	0.0025	0
542290	1.3236	2.2020							0
569713	1.7382	0.7177							0
571630	1.9722	3.9847*	2.35	0.0407	2.85	0.0173	0.29	0.7750	1
571748	3.3029	0.2536							0
582834	1.4067	5.1896*	-1.28	0.2293	3.57	0.0051	-0.33	0.7460	1
611662	1.1178	0.6085							1
627151	2.3225	0.5846							0
631226	12.6864**	2.8781							1
636905	15.1452**	2.0087							0
671400	49.3650**	1.1808							1
680665	8.8251**	0.4594							0
694478	1.2554	1.9167							0
711030	1.2677	0.3954							1
742718	1.8019	1.9355							1
743396	1.4940	0.8050							1
744499	2.8363	2.7588*	-1.74	0.1128	0.82	0.4297	2.81	0.0185	0
747402	4.5089	0.0371							1

Table 3 (continued)
Summary of Structural Change Tests

CUSIP	F RATIO EQU (6)	F RATIO EQU (4)	T RATIO $H_0{:}a_3{=}0$	P VALUE	T RATIO $H_0{:}a_4{=}0$	P VALUE	T RATIO $H_0{:}a_5{=}0$	P VALUE	TYPE
747403	2.2893	0.6372							0
749901	20.7489**	0.0732							1
775371	1.5471	1.1060							0
782242	2.5866	0.9186							1
783549	1.1104	0.5275							1
804787	1.0237	1.0346							1
806857	27.6910**	4.3545*	1.80	0.1023	1.13	0.2846	1.73	0.1142	1
812132	2.4533	0.2858							1
817565	3.9112	0.5538							0
824348	2.4608	0.3308							1
829302	81.5839**	3.8918*	-3.49	0.0058	-0.74	0.4775	-0.01	0.9904	1
841297	2.9263	4.7702*	0.35	0.7310	1.54	0.1550	1.87	0.0913	1
844741	8.2163**	1.2455							1
854616	1.5058	1.0809							0
868443	3.4029	5.2916*	-3.62	0.0047	-1.96	0.0790	-3.04	0.0125	1
872649	4.2460	0.5610							1
882508	35.0115**	2.5617							1
883203	3.7952	4.5492*	-0.45	0.6650	-3.19	0.0097	0.16	0.8774	1
889073	1.9492	0.3324							1
892348	1.6987	5.5405*	0.32	0.7584	3.48	0.0059	0.64	0.5350	1

Table 3 (continued)
Summary of Structural Change Tests

CUSIP	F RATIO EQU (6)	F RATIO EQU (4)	T RATIO $H_0: a_3=0$	P VALUE	T RATIO $H_0: a_4=0$	P VALUE	T RATIO $H_0: a_5=0$	P VALUE	TYPE
893485	1.1360	0.4619							0
893552	3.4783	2.1679							1
902182	1.6396	0.3827							1
903293	1.4384	3.4881*	-1.29	0.2246	3.00	0.0134	1.04	0.3221	1
907818	3.2655	6.3194*	-2.36	0.0399	-0.04	0.9714	-1.02	0.3333	1
912605	2.0276	1.0468							1
922272	3.0638	1.8660							1
929794	85.3524**	5.1425*	1.47	0.1720	-3.48	0.0060	1.79	0.1035	1
933169	1.0286	2.4281							0
934488	9.3295**	2.4779							1
962166	1.6602	3.5492*	0.90	0.3914	1.74	0.1131	0.99	0.3472	1
963320	1.6000	0.5040							1
989070	2.0870	4.1200*	-1.08	0.3046	-2.08	0.0638	0.22	0.8279	0
989569	3.1471	1.1071							1

* indicates significance at the 90 percent confidence level.
** indicates significance at the 95 percent confidence level.
a_3, a_4, and a_5 are the coefficients in equation (9).

Table 4
Signs of Dummy and Dummy Interaction Terms

	a_3		a_4		a_5	
	+	-	+	-	+	-
Positive Signals	18	27	21	24	24	21
Negative Signals	25	44	27	42	42	27

Table 5
Summary of Sign Test Outcomes

		Z Statistics	
Variable	D	(D)(t)	(D)(E_{mt})
Positive Signals	-1.4907	-.5962	.2981
	(.93)	(.72)	(.38)
Negative Signals	2.1669	1.6854	-1.9261
	(.015*)	(.045*)	(.97)

P values are presented in parentheses
*Significant at the .05 level