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Ex-Date Stock Price Adjustment to Stock Dividends: A Note

J. RANDALL WOOLRIDGE*

I. Stock Dividends and Share Prices

EISEMANN AND MOSES [6] RECENTLY surveyed the chief financial officers of over 30 firms which had paid stock dividends in 1974.¹ The officers overwhelmingly expressed the belief that stock prices do not fully adjust for stock dividends and that therefore the total value of stockholdings increases.² Twenty years ago, the Committee on Accounting Procedure made the same observation [2, p. 51]:

Many recipients of stock dividends look upon them as distributions of corporate earnings and usually in an amount equivalent to the fair value of the additional shares received. Furthermore, it is to be presumed that such views of recipients are materially strengthened in those instances, which are by far the most numerous, where the issuances are so small in comparison with the shares previously outstanding that they do not have any apparent effect upon the share market price and, consequently, the market value of the shares previously held remains substantially unchanged.

This phenomenon suggests inefficient market behavior. In a perfect markets environment with perfectly divisible financial assets, homogeneous investor expectations, and no taxes or transactions cost, the expected price adjustment as of the ex-dividend day is the last closing price prior to the ex-date divided by one plus the stock dividend. If ex-date stock price declines tended to be less than (greater than) the expected price adjustment, investors would buy (short sell) the stock the day prior to the ex-date and reverse the transaction the following day. In this manner arbitragers would eliminate abnormal price behavior around the ex-day.

However, market imperfections prohibit full price adjustment on the ex-date. If the stock dividend is not divisible by $\frac{1}{8}$ (.125), then the price cannot adjust fully since trading only occurs at \$.125 intervals on organized stock exchanges.³

* Pennsylvania State University. The comments of Michael J. Brennan and Thomas E. Copeland are greatly appreciated. All errors, however, are entirely my own.

¹ Stock dividends are distributions of dividends in the form of common stock. As a basis for distinguishing between stock dividends and stock splits for listed firms, the New York Stock Exchange classifies distributions of less than 25% as stock dividends.

² Several recent studies have reported significant positive stock returns on stock dividend announcement dates (see Foster and Vickrey [7] and Woolridge [9]). These results are generally attributed to the information stock dividend announcements convey to investors concerning future firm prospects, and not to the stock dividends themselves.

³ Other market making rules should not influence ex-day price adjustments. For example, limit orders are adjusted for stock dividend distributions.

The existence of transactions costs and taxes may also cause the stock price drop to be less than the expected adjustment. Arbitragers will only eliminate abnormal price behavior to the point where the price decline equals the expected adjustment minus transactions costs and/or taxes. Of course, an arbitrager cannot establish a profitable trading rule without covering transactions costs. Furthermore, the fact that stock dividends, especially smaller distributions, increase the number of investors holding shares in odd lots may increase the effect of transactions costs on ex-date stock price adjustment.⁴ As for the impact of taxes, while stock dividends, per se, are not taxable as income, fractional shares are normally paid in cash and these distributions are taxable.⁵ This effect, which may add to the impact of transactions costs on ex-date price adjustment, is larger for smaller stock dividend distributions in which the number of fractional share payments is greatest.⁶

II. Empirical Studies

Chottiner and Young [3] hereafter CY, and Foster and Vickrey [7], hereafter FV, have analyzed stock price behavior around the ex-dates for stock dividends. CY investigated ex-dividend day stock price behavior around 945 stock splits and dividends declared by NYSE firms over the 1963–1968 period. None of these splits or stock dividends were accompanied by cash distributions of any kind. CY defined the theoretical ex-dividend day opening price (T) as the prior day closing price adjusted for the stock dividend and for the overnight market movement as measured by the Dow Jones 65 average. They compared actual ex-date opening prices to T and tested the null hypothesis that p , the population proportion of time that shares opened above T on the ex-date, is .5. They found that for distributions of 3% or less, and for distributions of 25% to 200%, p is greater than .5, and they concluded that within these size ranges stock prices do not fully adjust for stock distributions.⁷

While CY showed that a significant proportion of opening prices are higher than the theoretical opening prices, they did not determine the magnitude of the difference. It is possible that this finding is due to indivisibilities alone, and that

⁴ Trading costs are higher for odd lots than round lots.

⁵ Stock dividends are taxable only if they are used to discharge preferred stock dividend obligations or if shareholders have the alternative of receiving cash, property, stock rights, or stock.

⁶ The impact of stock dividends on common stock liquidity or risk, or shareholder expectations could also result in abnormal ex-date returns. The liquidity argument seems weak, however, given Copeland's [5] finding that liquidity actually declines following stock splits. Also, there is no apparent change in risk. The only capital structure change for the declaring firm is a book transfer of an amount equal to the market value of the distributed shares from retained earnings to permanent capital. Finally, investor expectations may be altered on the ex-date since stock dividends, as opposed to cash dividends, are not legal liabilities to the firm once declared. Consequently, there may be some uncertainty resolved once a stock goes ex-dividend. But, given that stock dividends are very rarely declared and not paid (none were discovered in this study), it is highly unlikely that a stock dividend going ex-dividend conveys any information to shareholders.

⁷ Barker [1] also examined the prior day's closing price to the ex-date's opening price for stock distributions of 5%, 10%, and over 10%. He found that only in the 5% category did less than full stock price adjustment occur. But, he attributed this result to the fact that many of these distributions were accompanied with cash dividends.

the difference between the opening and theoretical opening prices is not significant.

FV examined stock prices around the ex-dates of stock dividends issued by NYSE firms over the 1974–76 period. They used closing rather than opening prices on the ex-date. They did not omit the stock dividends of firms which also paid cash dividends, but did screen their sample to ensure that other firm specific information was not announced around the ex-date. For their sample of 82 stock dividends, FV analyzed market model residuals and found the ex-date residual to be insignificantly different from zero.

While FV's results are intuitively appealing, several refinements are necessary. They included cash dividend paying firms in their sample which confound the impact of stock dividends on security prices. In addition, they used ex-date closing prices and did not examine the price adjustment as of the ex-date open. Finally, they employed the market model to risk adjust returns on a daily basis. Betas estimated on a daily basis for individual firms tend to be insignificant and unstable and are subject to nonsynchronous trading problems. These shortcomings are avoided in this study.

III. Data and Methodology

Stock price behavior around ex-stock dividend days is analyzed in two stages. First, in the spirit of CY, ex-date opening prices are compared with theoretical opening prices. In addition, the magnitude of the overnight price adjustment is analyzed using the prior day close to ex-day open stock returns. Second, following FV, ex-day returns are examined using the closing prices of the ex-date and the day before, and adjusting for the payment of the dividend. These returns are compared to the mean daily return of a representative period around the ex-date for inference purposes.

A. Data

All post 1964 stock dividends (stock distributions less than 25%) declared and paid by NYSE listed firms were initially considered for inclusion in the sample. Two sample selection screens were then employed. The cash dividend screen eliminated the stock dividends of firms which concurrently or within the last three years paid cash dividends. This screen reduced the sample from 1845 to 733. The extraneous information screen eliminated the stock dividends of firms which had any other significant news announcements (sales, earnings, etc.) published in the *Wall Street Journal* (WSJ) within two days of the declaration or ex-dates (as indicated in the *Wall Street Journal Index*). This screen further reduced the sample to 317.

For the first stage of the study, closing and opening prices were collected from the WSJ. However, since the WSJ stopped listing opening prices in 1972, the sample size was limited to 188. The daily returns were available over the entire sample period from the CRSP Daily Stock Return Files. For the ex-dividend day, the daily returns (r_t) are computed in the following manner:

$$r_t = (P_t(1 + s)/P_{t-1}) - 1 \quad (1)$$

where

P_t = closing price on the ex-date;

P_{t-1} = closing price on the day prior to the ex-date; and

s = stock dividend size

IV. Statistical Tests

In comparing the opening price on the ex-day with the closing price of the previous day no adjustment is made for overnight market movement. The theoretical opening price is the prior day closing price divided by one plus the stock dividend rate.

To test the null hypothesis that the proportion (p) of time the opening price is above the theoretical price is .5, the normal approximation of the binominal distribution is employed. To test the size of the price adjustment on the ex-date, the close-to-open returns (r_t) are calculated using Equation (1) and substituting the ex-date open price for P_t . Under the null hypothesis that the close-to-open stockholder return is zero, a t statistic can be constructed in which $\bar{r} \sim N(0, \sigma^2/N)$:

$$t = \frac{\bar{r}}{\sqrt{s^2/N}} \quad (2)$$

where s^2 is an estimate of σ^2 .

To analyze ex-day returns using closing to closing prices, a variant of the Comparison Period Returns Approach (CPRA) is used.⁸ The CPRA may be specified as follows.⁹ Assuming stationarity, a security's return ($\tilde{r}_{it}$) over time can be specified as

$$\tilde{r}_{it} = \mu_{it} + \tilde{\epsilon}_{it} \quad (3)$$

where μ_{it} is the expected return of security i , and $\tilde{\epsilon}_{it}$ is a stochastic error term which has an expected value of zero and is uncorrelated over time.

The impact of new information on security prices may be discovered through an examination of ϵ_{it} 's. To determine if the ϵ_{it} 's around an event date are nonzero, a test is conducted to determine if the mean daily return of the event period (observation period) is statistically different from the mean daily return of some other representative time period (the comparison period). The mean daily return for the comparison period is actually an estimate of μ_{it} , the expected daily return in (3). To minimize error in the estimation of μ_{it} , portfolios of securities are formed in event time around announcement dates. If security returns are independent and stationary over time with finite variances, portfolio daily returns in large samples approach normal distributions. Therefore, a student- t for the

⁸ Using monthly returns Brown and Warner [2] have shown the CPRA to be at least as powerful as market adjusted approaches in detecting significant price movements for nonclustered events. Masulis [8] notes that this conclusion is even stronger when using daily returns due to the very low and often insignificant relationship of the market model when applied on a daily basis.

⁹ Much of the CPRA discussion follows Masulis [8].

Table I
Comparison of Ex-Date Opening Prices and Prior Day Closing Prices

Distribution Size	<i>n</i>	Sign Differential			Close-to-Open Returns		
		<i>n</i> (+)	<i>n</i> (-)	$\bar{p}$	$\bar{r}$ (%)	$\sqrt{s^2/N}$	<i>t</i>
all	188	155	72	.612*	.548	.164	3.35 ¹
≤3%	107	68	39	.636 ¹	.673	.206	3.26 ¹
>3% <25%	81	47	33	.580*	.384	.265	1.45

* Contains one tie.

¹ Significant at .01 level.

² Significant at .10 level.

difference in population means can be employed to test for equality of event period and comparison period mean returns.

IV. Empirical Results

A. Closing-to-Opening Prices

Table I contains the results for the comparison of the ex-date opening price and the theoretical opening price. The ex-date opening prices are significantly above the theoretical opening prices for the entire sample and for 2 subsamples (≤3% and >3%). Overall, sixty-one percent of the opening prices are above the theoretical opening prices.

Statistics for the close-to-open returns are also given in Table I. For the entire sample the mean return ($\bar{r}$) of .55% is significantly above zero at the .01 level. For the small distribution (≤3%) subsample, the mean return of (.67%) is also significant at the .01 level. However, the mean return for large distribution (>3%) subsample (.38%) is only significant at the .10 level.

B. Closing-to-Closing Prices

Two different comparison periods are employed in this study: the 60 days before and after the ex-dates (comparison period A) and just the 60 days after the ex-dates (comparison period B). Since the ex-dividend date is known in advance, its effect on stock returns is limited to one day.

The portfolio daily return (PDR), the cumulative portfolio daily return (CPDR), and the percent of daily returns greater than zero (PDRGZ) are given in Table II for the 61 days around the ex-dates for the entire stock dividend sample. Summary statistics for both comparison periods and the ex-date for the entire sample, as well as for subsamples stratified by stock dividend size, are contained in Table III.

For the entire sample, the mean ex-date PDR (.986%) is 5.15 standard deviations larger than the mean PDR (.057%) of comparison period A and 5.89 standard deviations larger than the mean PDR (-.004%) of comparison period B.¹⁰ The large difference in the mean PDRs of comparison periods A and B is attributable

¹⁰ This was computed using the standard deviation of the comparison period returns. Because the observation period consists of only one day, strict statistical inferences cannot be made. However, cross-sectional *t*-statistics were also calculated with much the same results.

Table II
Close-to-Close Portfolio Returns for Entire Stock Dividend Sample $n = 17$

Event Day	Portfolio Daily Return (%)	Cumulative Portfolio Daily Return (%)*	Percent of Returns Greater Than Zero	Event Day	Portfolio Daily Return (%)	Cumulative Portfolio Daily Return (%)*	Percent of Returns Greater Than Zero
-30	0.04229	2.73187	43.04	01	0.08112	8.17063	39.24
-29	0.06595	2.79783	42.09	02	0.06054	8.23117	41.14
-28	-0.04370	2.75413	34.18	03	0.23834	8.46951	38.92
-27	0.09357	2.84770	40.51	04	-0.10582	8.36369	36.08
-26	0.12552	2.97322	41.77	05	-0.07270	8.29099	37.97
-25	0.16642	3.13964	41.46	06	0.06528	8.35627	37.34
-24	-0.06888	3.07076	38.29	07	-0.32241	8.03386	35.13
-23	-0.07890	2.99186	36.39	08	-0.11131	7.92255	35.44
-22	0.16271	3.15457	38.92	09	0.00036	7.92291	37.66
-21	-0.08597	3.06860	34.81	10	-0.24844	7.67447	37.66
-20	0.20939	3.27799	41.77	11	-0.03498	7.63949	37.66
-19	-0.05501	3.22299	37.66	12	0.19920	7.83869	40.51
-18	-0.05842	3.16456	38.61	13	-0.05273	7.78597	37.66
-17	0.07309	3.23765	41.77	14	-0.17471	7.61125	33.86
-16	0.12898	2.36664	38.61	15	-0.16439	7.44687	31.65
-15	0.31482	3.68145	39.87	16	0.19117	7.63803	40.82
-14	-0.05196	3.62949	37.97	17	0.03478	7.67282	37.34
-13	-0.01174	3.61774	35.13	18	-0.00112	7.67169	39.56
-12	0.26657	3.88432	41.77	19	-0.28724	7.38446	37.97
-11	0.16322	4.04754	37.66	20	0.23828	7.62274	42.72
-10	-0.07331	3.97423	42.72	21	0.17982	7.80255	42.41
-09	0.29854	4.27277	44.94	22	0.25642	8.05897	42.41
-08	0.21598	4.48875	44.62	23	0.28097	8.33994	43.35
-07	0.31166	4.80041	44.94	24	0.13186	8.47180	40.51
-06	0.40318	5.20360	43.35	25	0.14976	8.62156	40.82
-05	0.10102	5.30462	39.56	26	-0.06335	8.55821	34.81
-04	0.41153	5.71615	43.04	27	0.11438	8.67259	41.14
-03	0.16753	5.88368	42.09	28	-0.11344	8.55915	36.08
-02	0.63287	6.51655	48.10	29	0.11463	8.67378	41.77
-01	0.60453	7.12108	48.73	30	-0.13266	8.54112	36.39
0	0.96843	8.08951	58.86				

* This statistic reflects the CPDR for the entire 121 days around the ex-dates (comparison period A).

to the information effect of stock dividend announcements on stock prices which is reflected in the mean PDR of comparison period A. Although this makes the mean PDR of comparison period B lower than the mean PDR of comparison period A, the overall results of the tests are not influenced. The PDRGZ for the ex-dividend day (58.86%) is substantially larger than the mean PDRGZ for both comparison periods A (39.38%) and B (38.42%). For the subsamples, the ex-dividend day PDRs and PDRGZ are all much larger than their respective comparison period mean PDRs and PDRGZ. The ex-day PDR (PDRGZ) increases from .564% (56.25%) for category 1 (<3%) to 1.480% (63.37%) for category

Table III
Summary Statistics for Ex-Dividend Day and Comparison Period Returns

Ex-Dividend Day			Comparison Period			
Category	Portfolio Daily Return (%)	Percent Daily Returns >0	Comparison Period*	Mean Portfolio Daily Return (%) (Standard deviation)	Mean Portfolio Daily Returns > 0 (Standard deviation)	Relative Size Differential ^{1, 2}
all <i>n</i> = 317	.968432	58.86	A	.057337 (.17698)	39.38 (3.0527)	5.15
			B	-.00401 (.16503)	38.42 (2.6867)	5.89
(1) <3% <i>n</i> = 80	.563620	56.25	A	.041486 (.30443)	39.92 (5.8174)	1.72
			B	-.043853 (.30070)	39.19 (5.6271)	2.02
(2) ≥3% ≤5% <i>n</i> = 103	.963384	57.84	A	.066867 (.28311)	40.54 (4.6745)	3.17
			B	.02276 (.27849)	39.56 (4.4392)	3.38
(3) ≥5% ≤6% <i>n</i> = 101	1.480167	63.37	A	.060838 (.31981)	37.797 (4.8921)	4.44
			B	.011639 (.31991)	36.91 (5.1659)	4.59
(4) ≥6% <i>n</i> = 33	.399368	54.55	A	.061822 (.47217)	39.50 (8.5161)	0.71
			B	-.038082 (.47180)	37.68 (8.8807)	0.93

* A: Results using comparison period of 60 days before and after ex date. B: Results using comparison period of 60 days after ex date only.

¹ Ex-Dividend Day PDR – Mean Comparison Period PDR
Std. Dev. (Comparison Period PDRs)

² These results were corroborated using cross-sectional t-tests.

3 ($\leq 5\% \geq 6\%$), but declines to .399% (54.55%) for category 4 ($> 6\% < 25\%$).¹¹

These results, combined with those of the previous tests, support the hypothesis that stock prices do not fully adjust on the ex-date for stock dividend declarations.¹²

V. Summary and Conclusions

This paper examines the contention that small stock distributions increase shareholder wealth due to less than full stock price adjustment on the ex-date. Through an investigation of day prior closing to ex-date opening and ex-date closing prices, it is shown that stock prices do not fully adjust for stock dividends and consequently stock dividend declarations increase the value of stockholdings. These abnormal returns are greatest for stock dividends of 6% or less.

Overall, these findings may be indicative of market imperfections, market inefficiency, or both. It is argued that indivisibilities, taxes, and transactions costs are market imperfections at least partially responsible for abnormal ex-date returns. Taxes and transaction costs may also cause the large abnormal returns associated with smaller ($\leq 6\%$) stock distributions. All else equal, smaller distributions result in larger numbers of fractional shares which are taxed as income and of odd lot shares which are more costly to trade. Nonetheless, the ex-date returns are large enough that investors who pay low transactions costs (such as floor traders), and/or who own shares in amounts such that they can avoid receiving fractional and odd lot shares, may be able to earn abnormal returns. If

¹¹ As a note of interest, the summary statistics for daily returns using closing to closing prices for the pre-1972 portion of the sample are:

Distribution Size	Ex-Dividend Day		Comparison Period		
	Portfolio Daily Return (%)	Percent Daily Returns > 0	Mean Portfolio Daily Return (Std. Dev.)	Mean Percent Daily Return > 0	Relative Size Differential
all	.854561	58.51	.061484 (.21451)	39.63 (3.9081)	3.70
$\leq 3\%$ $N = 107$	.971017	58.88	.043547 (.27419)	40.09 (5.4195)	3.38
$> 3\%$ $N = 81$	.700725	58.02	.085424 (.30556)	39.02 (5.6093)	2.01

When comparing these PDRs with the $\bar{F}$'s of Table I, two observations are worth mentioning: (1) about $\frac{1}{2}$ of the closing to closing return is attributable to less than full price adjustment as of the ex-day open; and (2) larger stock dividends are associated with smaller ex-day returns.

¹² One other finding which deserves attention is the relatively high CPDR observed for the two weeks (10 trading days) prior to the ex-dates. For days -10 to -1 , the CPDR is 3.15%. The primary reason for these returns is the information conveyed to investors through the stock dividend announcements (see Foster and Vickrey [7] and Woolridge [9]). For the entire sample, the average time period between announcement and ex-dates is 13 trading days. However, this distribution is highly skewed with a minimum of 2 days, a maximum of 64 days, and a median of 10 days.

this opportunity does indeed exist, it can be inferred that the market does not efficiently adjust stock prices for stock dividends.

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