Stock-Splits, the Bid-Ask Spread and the Information Hypothesis

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Abstract

Though many plausible explanations have been offered, the behavior of splitting shares remains an anomaly. Parameters of the stock return distribution shift around the time of the split announcement despite the fact that there is no obvious economic significance to the splitting of a firm's shares. This paper directly examines the Information Hypothesis as an explanation for the observed increase in means and variance of stock returns at the time of the split announcement. Results from an analysis of all splitting shares on the CRSP Tape reveals a relationship between the bid-ask spread and trading volume that is consistent with the Information Hypothesis.

Introduction

The empirical literature in finance documents an increase in residuals and variances around split announcement dates (FFJR, 1969; Chottner and Young, 1971; Grinblatt, Masulis and Titman, 1984; Ohlson and Penman, 1985; and Ball and Torous 1988). This finding is an anomaly since there is no obvious economic significance to a split and it may be argued that splits are cosmetic accounting practices. Alternatively, it can be argued that splits contain new economic information and an equity price response can be expected. This paper examines both alternatives and concludes that stock splits are information events. This result is consistent with the recent results of McNichols and Dravid (1986), Lakonishok and Lev (1987) and Brennan and Copeland (1988).

Rather than focusing on the nature of the information content of splitting shares, we attempt to document directly its existence. We believe as Grinblatt (1984) et al. suggest that the split can be used by managers simply as an attention getting mechanism while the nature of the information signaled may be as varied as are the firms that split.

If splits are cosmetic and occur for reasons such as the stock is trading outside its normal range, then splits may be predictable when share prices become high. Multiple splits, (i.e., second and subsequent splits by the same firm) provide an opportunity to examine this conjecture. However, since we find no evidence of a difference in the market response to first or subsequent splits, we consider the Information Hypothesis. If splits are interpreted by the market as conveying information, then a stock price response may be expected and this response should be no different for the first or subsequent splits, as new information may be conveyed each time the share is split. To evaluate the Information Hypothesis, this paper examines the relationship between the bid-ask spread and volume transactions.

In Section II, we examine the return behavior of splitting shares, focusing on the possibility that splits are cosmetic and therefore they may be predicted when firms split more than once. If splits are predictable, this implies that they may not be information events and therefore splitting per se will have little impact on the distribution of stock returns. Finding no evidence of a differential market response dependent upon the number of times a firm

splits, Section III examines the bid-ask spread and trading volume relationship in order to test the Information Hypothesis as a possible explanation for splitting shares. Section IV contains a discussion of the estimation of the bid-ask spread, while Section IV presents our empirical findings for both daily and transaction data. Section IV summarizes the results of our analysis and contains our conclusions.

Return Behavior Associated With the Announcement of a Split

The observation of a stock price response to the announcement of a forthcoming split should not be surprising if splits are a means of signaling information to the market. If splits, however are purely cosmetic and can be anticipated when share price becomes high, then we would expect to find little or no change in the stock return variance around the announcement date.(1) If splits convey information, however, we would expect an increase in the variance of returns on the splitting stock as investors attempt to interpret the announcement and trade in order to appropriately adjust their holdings. In a recent paper, Ball and Torous (1988) corroborate Christie's (1983) argument that errors of inference in statistical testing may occur when a researcher assumes there is no increase in variance associated with an event day when actually there is. Ball and Torous, use a more powerful maximum likelihood estimation technique to examine the abnormal performance of splitting shares. Their results confirm Grinblatt, Masulis and Titman's conclusions, concerning the change in the return parameters of a splitting share.(2)

In order to examine the return behavior of splitting shares, we identify all firms on the Daily CRSP Master file that have split their shares. The date of the first public announcement of the split is provided by CRSP and where missing, we use the first public announcement as reported in the Wall Street Journal Index. The universe of splitting shares is then divided into subsamples according to the frequency with which the shares have split. Five such subsamples are generated. We obtain daily returns from CRSP for all firms for 16 days on either side of the announcement, thus allowing the creation of three eleven day subperiods termed the pre-announcement, announcement, and post-announcement periods. The subperiods are constructed on this basis since most event studies document announcement effects during the five days on either side of the announcement (see Fama, 1970; Kaplan and Roll, 1972; and Sunder, 1973). Event time portfolios are then constructed and the respective means, variances and average spreads for each portfolio are calculated and compared across subperiods.

The results of our examination of the parameters of the daily return distribution are reported in **Table 1** and **Table 2**, while average bid-ask spreads are reported in **Table 3.** All samples reveal a decrease in mean portfolio return from the pre-announcement to the post-announcement period. Further, there is a consistent increase in the variance of return from the pre-announcement to the announcement subperiod that is statistically significant. It is unaccompanied by statistically significant increase in announcement period returns suggesting that this increase in gross risk may be diversifiable for most shareholders. There is also an increase in the average spread during the announcement period.

These findings appear inconsistent with the position that splits contain no economic information. If purely cosmetic, there should be no statistically significant changes in the return distribution when a split is announced. Furthermore, there is no difference in the return behavior between single and multiple splitting firms. Rather, these findings may be interpreted as broadly consistent with the hypothesis that the announcement of a split signals new information to the market and traders act upon it. We do not examine the information content of the split. However, previous research suggests that splits signal the firm's future prospects.

Table 1

TABLE 1: MEAN AND VARIANCE OF PORTFOLIO RETURN
AROUND THE ANNOUNCEMENT OF A SPLIT

		SUBPERIOD 1 (t=-16 to t=-6)		SUBPERIOD 2 (t=-5 to t=5)		SUBPERIOD 3 (t=6 to t=16)	
SAMPLE	SAMPLE SIZE	$\overline{X}$	S^2	$\overline{X}$	S^2	$\overline{X}$	S^2
All Splits	3194	0.0030490507	0.0000001250	0.0047573009	0.0000235931	0.0002813926	0.0000000854
One Split	913	0.0028158179	0.0000005630	0.0044687115	0.0000289931	-0.0002040535	0.0000001328
Two Splits	933	0.0032336675	0.0000004308	0.0046972688	0.0000207087	-0.0001710766	0.0000004533
Three Splits	641	0.0029693093	0.0000012658	0.0050345922	0.0000233340	0.0007928889	0.0000011488
Four Splits	404	0.0031621399	0.0000009244	0.0051575720	0.0000289205	0.0008821579	0.0000010630
Five or More Splits	303	0.0032012631	0.0000027174	0.0046914221	0.0000204478	0.0012542904	0.0000026866

$\overline{X}$ = Mean Portfolio Return

S^2 = Variance of Portfolio Return

TABLE 2: CHANGES IN THE RETURN DISTRIBUTION
AROUND THE ANNOUNCEMENT OF A SPLIT

	MEAN (t statistics are provided in the parentheses)		RATIO OF VARIANCES	
SAMPLE	$\overline{X}_{PRE} - \overline{X}_{POST}$	$\overline{X}_{ANNOUNCE} - \overline{X}_{PRE}$	S^2_{PRE}/S^2_{POST}	$S^2_{ANNOUNCE}/S^2_{PRE}$
All Splits	0.00276766 (21.775*)	0.00170807 (1.264)	1.470*	188.74*
One Split	0.00301987 (11.455*)	0.00165289 (0.961)	4.265*	51.497*
Two Splits	0.00340474 (11.457*)	0.00156360 (1.006)	1.053	48.158*
Three Splits	0.00217642 (4.430*)	0.00206528 (1.316)	1.101	18.445*
Four Splits	0.00227998 (5.114*)	0.00199543 (1.155)	1.150	31.298*
Five or More Splits	0.00194697 (2.640*)	0.00149016 (0.979)	1.011	7.525*

$\overline{X}_{PRE}, S^2_{PRE}$ = Mean and variance of return respectively during the pre-announcement period, t = -16 to t = -6.

$\overline{X}_{ANNOUNCE}, S^2_{ANNOUNCE}$ = Mean and variance of return respectively during the announcement period, t = -5 to t = 5.

$\overline{X}_{POST}, S^2_{POST}$ = Mean and variance of return respectively during the post announcement period, t = 6 to t = 16.

* The ratio of the variances follows an F distribution. An asterisk indicates significance at $\alpha = 0.05$.

TABLE 3: CROSS-SECTIONAL MEDIAN VALUE OF SPREAD (%) AROUND THE ANNOUNCEMENT OF A SPLIT*

SAMPLE	SUBPERIOD 1	SUBPERIOD 2	SUBPERIOD 3
One	.9600	1.1589	1.0264
Two	1.1766	1.3912	1.2528
Three	1.3328	.7904	1.1951
Four	1.7787	1.3788	1.8284
Five or More Splits	1.3257	1.9304	1.4303

*Mean values display the same pattern as reported here.

Recently, Lakonishok and Lev (1987) report that the earnings of firms that split subsequently grow faster than the earnings of a control sample of non-splitting shares. McNichols and Dravid (1986) also report that splits are followed by increases in earnings per share. The decrease in mean portfolio returns during the post-announcement period is consistent with increased transaction costs and an increase in the bid-ask spread. Likewise, the increase in the variance over the announcement period is consistent with increased trading activity due to different interpretations of the split.(3) Brennan and Copeland (1988) present evidence which suggests that managers attempt to use a split to signal information to the market about the firm's true or correct value. This signal is costly because transaction costs depend on stock prices. (Lower stock prices imply proportionally higher transaction costs). Further, an investor who prior to a split owned a round lot, may find himself with increases in transaction costs resulting from his post-split odd lot holdings. Rather than directly examining the signaling mechanism, or attempting to document the nature of the information signaled, we estimate the bid-ask spread to find support (or lack of it) for the information hypothesis itself.

The Bid-Ask Spread and Trading Volume Relationship

To determine if the observed parameter shift in the return distribution is due to information contained in the announcement of a split, we examine the bid-ask spread and volume relationship surrounding the announcement period. There are two competing hypotheses concerning the relationship between bid-ask spread and volume (Demsetz, 1977; Copeland, 1979; Copeland and Galai, 1983). With no new information in the marketplace, competition among market makers implies an inverse relationship between volume and the bid-ask spread. As transaction volume increases, competition among market makers will cause the bid-ask spread to narrow. We call this the Competition Hypothesis. Alternatively, with information arrival, volume trading would be expected to increase. Around the split announcement period there are still some traders buying and selling for exogenous reasons of their own (such as liquidity). But others are trading due to the perceived information content of the split (Copeland, 1976, 1977; Jennings, Stark and Fellingham, 1981). If a market maker were to set a single price to buy and another to sell, on average he would neither gain nor lose to the trader who trades for exogenous reasons of his own. He would systematically lose, however to information-based traders by buying prior to abnormal stock price declines and selling prior to abnormal stock price increases.

Since the market maker cannot distinguish between the two types of traders, he increases

the spread to charge all traders the expected value of the information. He will lower his bid price to reflect unfavorable information and raise his ask to reflect favorable, thus causing an increase in the mean bid-ask spread around a suspected information event. With such an increase, the market maker may still incur losses to information based traders, but they can be offset by profits from traders who trade for exogenous reasons. This argument is a combination of the information/volume relationship suggested by Copeland (1976, 1977) and the adverse selection induced spread hypothesis suggested by Glosten and Milgrom (1985). For convenience we will call this the Information Hypothesis. With an examination of the relationship between bid-ask spread and volume we can distinguish between the Competition Hypothesis and the Information Hypothesis.

Estimating the Bid-Ask Spread and Volume Relationship

Roll (1984) has shown that in an efficient capital market (in the absence of information), the bid-ask spread can be estimated from the serial covariance of price changes.(4) Using logarithmic percentage returns, rather than prices, Rolls' estimate of the bid-ask spread can be expressed as:

$$\hat{S}_{jt} \quad 200\sqrt{-COV_{jt}}$$

where

$\hat{S}_{jt}$ = spread estimate for firm j over time period t
COV_{jt} = serial covariance of returns for firm j over time t.

The serial covariance is calculated as:

$$COV_{jt} = \frac{1}{N} \sum_{t=1}^{N-1} [(R_t - \bar{R})\ (R_{t+1} - \bar{R})]$$

Beginning 16 days before the announcement of a split, we calculate individual firm spreads.(5) Daily trading volume for each firm is obtained from the Interactive Data Corporation and is standardized by the number of shares outstanding. Standardization is necessary to prevent our regression results from being unduly influenced by larger firms. We calculate a time series of spread estimates for individual firms and coupled with a time series of standardized volume observations we estimate the following cross-sectional regression:

$$S_{it} = \beta_0 + \beta_1 V_{it} + \epsilon_{it}$$

S_{it} = is the estimated spread for firm i on day t
V_{it} = number of shares of firm i traded on day t standardized by the total number of shares outstanding for firm i on day t.

We expect beta one to be less than zero if day t is a period of no information and competition between market makers accounts for the inverse relationship between spread and volume. Beta one should be greater than zero if information implied in the split causes a positive relationship between spread and information based trading volume.

Empirical Results

The results of our daily cross-sectional regression are reported in **Table 4.** Prior to the announcement of the split, it appears that the relationship between the bid-ask spread and trading volume is inverse. These results are consistent with the hypothesis that competition among market makers narrows the spread. On the announcement date of the split, however, the spread-volume relationship becomes significantly positive. This result is consistent with the Information Hypothesis. As volume trading increases, the market maker attributes this to information-based traders. He cannot ascertain however, whether the information is positive or negative, nor can he distinguish between liquidity traders and information traders. Thus, he increases the spread to charge all traders the expected value of the information. This positive bid-ask spread and volume relationship continues for several days as the market makers continue to charge traders an increased transaction cost. This prolonged adjustment in the transaction cost is consistent with the empirical evidence that indicates that abnormally high volume trading continues for an extended time after information events (see Beaver, 1968; Morse, 1981).

TABLE 4: ESTIMATES OF THE SPREAD-VOLUME RELATION AROUND THE ANNOUNCEMENT OF A SPLIT: DAILY DATA
(t-statistics are provided in the parentheses)

$$S_{i,t} = \beta_0 + \beta_1 V_{i,t} + \varepsilon_{i,t}$$

EVENT DAY	β_0	β_1
-5	0.2263 (2.130)*	-0.0557 (-2.493)*
-4	0.2660 (2.496)*	-0.0533 (-2.344)*
-3	0.1349 (1.306)	-0.0222 (-1.086)
-2	0.1476 (1.371)	-0.0184 (-0.867)
-1	0.1155 (1.050)	-0.0129 (-0.706)
0	0.0809 (0.764)	0.0261 (1.709)**
1	-0.0265 (-0.262)	0.0259 (1.505)
2	-0.1588 (-1.586)	0.0381 (1.855)*
3	-0.1797 (-1.923)**	0.0362 (2.058)*
4	-0.0787 (-1.206)	0.0348 (2.684)*
5	0.0186 (0.272)	0.0057 (0.410)

*indicates statistical significance at $\alpha = 0.05$.
**indicates statistical significance at $\alpha = 0.10$.

In order to test the robustness of our findings, we re-estimated equation (3) using daily transaction data.(6) The Francis Emory Fitch data file of security prices was used for this estimation. This file consists of all NYSE trades during the 1979-1984 period. Using the Roll estimator with transaction data we expect a slightly different result than that which we obtained in the first regression. Estimating the spread over a period of days, creates some serial dependence in our estimate, and magnifies the nature of the spread -- volume relationship. In some sense, using intra-day data eliminates this "magnification effect," and makes the effects of information trading harder to detect. This is because in the information trading case, volume transactions would be expected to increase and the increase in volume has the opposite effect (narrowing the spread) that information does.

When trading volume is the principal determinant of spread, the regression results of Roll's

spread estimator against volume should show this significance, i.e. beta one should be statistically significant. We expect this result in the pre-announcement period when there is no unusual level of information based trading. When trading volume is not the only determinant of the spread, and instead infer that information causes market makers to widen the spread, we expect the relationship between Roll's estimator and trading volume to be insignificant, i.e. beta one should not be statistically significant. This result we expect, when according to our hypothesis the spread is influenced by the presence of an unusual level of information based trading at the split announcement.

The results using intra-day data are presented in **Table 5**. For the pre-announcement period the regression coefficients are indeed significant. This implies that trading volume is a significant determinant of the market spread. At the announcement of the split, i.e. on day t = 0, the significance vanishes, suggesting that trading volume is not the only, nor the predominant determinant of the spread. In fact, the absence of a significant relationship between volume and spread suggests that something else -- (we infer the information content of the split) -- is the cause of the observed spread.

The difference between the set of results with transaction data and that obtained with daily data may be due to difficulties with Roll's measure. That is, Roll's estimator appears correct only when there is no information component to the spread (see Glosten and Harris 1988). With a finer partitioning of the data set due to transaction data, the effects of the split information are not observed in the pre-announcement period. In the post announcement period, they override the normal or usual relationship between spread and volume. The directional results for the post announcement period are consistent with those obtained from the daily data analysis. Both suggest that during the information period the relationship between spread and volume trading is positive.

Conclusions

Although often considered to be a mere accounting practice, stock splits have been shown both in this paper and elsewhere to produce a shift in the parameters of the return distribution. This is expected around an information event, thus suggesting that a stock split may be more than cosmetic and indeed may convey economic information. The results in this paper support such an inference. If splits are purely cosmetic and are not interpreted by the market as information events, second and subsequent splits should cause no stock price response. Yet, we find the same increase in announcement period variance for multiple splits as we do for single ones. An analysis of the relationship between bid-ask spread and trading volume also generally supports stock splits as information events.

This paper uses Roll's methodology to estimate the bid-ask spread for a security without obtaining actual market quotes. Successive return covariances using both daily and transaction data are calculated for individual firms. We estimate the cross-sectional relationship between spread and volume for the universe of splitting shares. Two hypotheses have been offered in the literature to explain this relationship. The Competition Hypothesis suggests that competition among market makers narrows the bid-ask spread as trading volume increases. The Adverse-Selection Hypothesis suggests that the bid-ask spread will widen as the market for a security becomes increasingly dominated by information-based traders. This implies a positive relationship between trading volume and the bid-ask spread around the announcement of an information-laden event. One would expect this information--volume relationship would be statistically hard to detect. An increase in information based trading (which implies an increase in spread) is also simply an increase in trading volume (which implies a decrease in spread). However, both of these hypotheses are supported by our empirical results. Prior to the first public announcement

TABLE 5: ESTIMATES OF THE SPREAD-VOLUME RELATION AROUND THE ANNOUNCEMENT OF A SPLIT: TRANSACTION DATA

$$S_{i,t} = \beta_0 + \beta_1 V_{i,t} + \varepsilon_{i,t}$$

EVENT DAY	β_0	β_1
-5	0.1062	0.0693 (2.432)*
-4	0.0984	0.0737 (2.339)*
-3	0.1172	0.0519 (1.878)**
-2	0.0841	0.0419 (2.225)*
-1	0.1709	0.0672 (2.406)*
0	0.1433	0.0298 (1.430)
1	0.1108	0.0449 (1.396)
2	0.0976	0.0566 (1.228)
3	0.1649	0.0783 (1.558)
4	0.1264	0.0301 (1.229)
5	0.1305	0.0467 (0.987)

of the pending split, we observe the significant relationship between spread and trading volume postulated by the Competition Hypothesis. At the announcement date and subsequent to it, the positive relationship provides support for what we call in this paper the Information Hypothesis. This suggests that stock splits do convey economic news to the marketplace. Market makers increase their spread since they suspect an increase in information based trading but are unable to discriminate between those trading for liquidity and those trading on the basis of the information contained in the split. We suspect that as spread estimates become more "fined-tuned" the information arrival associated with a split will be able to be more accurately and narrowly pin-pointed.

Endnotes

1 We focus on the announcement date, rather than the ex-date as Ohlson and Penman (1985) do, because we expect in an efficient capital market that the market response will occur as soon as news of the pending split becomes public.

2 See Christie (1983) for a discussion of variance increases around event dates.

3 Our interpretation of the increased announcement period variance is also consistent

with the results of Ohlson and Penman who find evidence of an increased variance at the ex-date and are unable to explain it as being due to calendar trends, statistical outliers, non-independence due to overlapping split periods, temporarily low pre-announcement variances, temporarily high post split variances or the abnormal behavior of mean returns.

4 Roll's methodology doesn't provide the actual spread observed in the marketplace. In fact, there is some evidence (see Choi, Salandro and Shastri, 1987) that his methodology consistently underestimates the actual spread. However, consistent underestimation will not affect the significance of our results. Roll's methodology generates the effective spread facing the dollar weighted average investor and might reasonably be thought of as the average transaction cost. More recent evidence by Glosten and Harris (1988) and Harris (1988) suggests that Roll's method of spread estimation is correct only when the market contains no new information. However, no sufficiently tractable alternative exists for use when there is an increase in suspected information based trading.

5 See Roll (1984) Appendix B for evidence that his spread estimate is robust to variations the time period of calculation.

6 Numerous variations of Roll's estimator and the regression were used in the analysis. They included standardizing volume by shares outstanding and using volume without standardizing it. Further to estimate Roll's spread, we used prices rather than returns and the actual magnitude of price changes. The result reported here are substantially unchanged regardless of the regression estimation techniques.

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