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Beta Changes around Stock Splits: A Note

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The great tragedy of Science—the slaying of a beautiful hypothesis by an ugly fact.

T. H. Huxley

NONSTATIONARITY IN THE DISTRIBUTION of security returns is a theoretically acceptable phenomenon that is well confirmed empirically. Less acceptable from a theoretical viewpoint is the possibility that the nonstationarity should be associated with "irrelevant" events such as stock splits and stock dividends. Yet Ohlson and Penman [6] have shown that the variance of stock returns exhibits a striking increase immediately following the effective date of a stock split, despite the fact that the split is announced in advance. This finding is confirmed by Dravid [2], who also reports a decrease in the variance at the time of stock dividends. Although Ohlson and Penman consider several possible explanations for this phenomenon, none seems to be consistent with the evidence. In this note, we report that the anomalous behavior of the return distribution extends to the "beta coefficient," which exhibits a temporary increase of about twenty percent at the time of a split announcement and increases about thirty percent at the time the split becomes effective; in the seventy-five days following the split, the beta remains about eighteen percent above its pre-split level. The data set is based on a sample of 1,034 splits used by Brennan and Copeland [1]. Betas are computed with respect to the CRSP equally weighted index.

I. Time-Series Estimates

We proceed initially by estimating the standard market-model betas for each security for three different time intervals that are defined relative to the split announcement and ex-date. Thus, define R_{jt} as the return on stock j on day t of the time interval, and define R_{mjt} as the contemporaneous return on the market portfolio; the j subscript is required because this is the return on the market portfolio on day t of the time interval for stock j. The standard market-model regression for stock j is

$$R_{jt} = a_j + b_j R_{mjt} + e_{jt}. \tag{1}$$

The first interval is the period between the split announcement and the date it becomes effective, which we call the "announcement interval." The mean number of trading days in the announcement interval is fifty-one, and the

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standard deviation is twenty-six; the longest announcement interval is 213 days, and the shortest is five days. The second interval is a period before the announcement date that, for each security, is the same length as the announcement interval. The third interval is a period of similar length after the ex-date. In estimating the three betas for each security, the returns on the announcement and ex-dates and the four days around them were excluded.

A possible cause of time-series variation in beta estimates is variation in the frequency with which the securities are traded, for it is well known that infrequent trading and the resulting nonsynchronicity of price observations create a downward bias in the estimates. To allow for this possibility, Scholes-Williams [7]-type betas were also calculated by summing the coefficients from three market-model regressions in which the market return is contemporaneous, lagged one day, and anticipated one day. This three-day estimator is proportional to the Scholes-Williams estimator, the constant of proportionality depending on the serial correlation of the market return. A similar five-day estimator was also calculated based on the Fowler-Rorke [3] generalization of the Scholes-Williams procedure. The five-day estimator employs leads and lags of two days and provides consistent estimates (up to the constant of proportionality determined by the market serial correlation) even if the security does not trade every day.

Table I reports the mean beta estimate for each of the three time intervals using the three different estimators. The results for the three different estimators are similar. There is no significant change in the mean beta estimate between the pre-announcement interval and the announcement interval. However, there is an increase of over twenty percent in the average estimate after the effective date of the split, and the t-statistic for the difference is in excess of five for both the OLS and the three-day estimators. The fact that all three estimators exhibit similar behavior suggests that the results cannot be attributed to changes in the frequency of trading.

II. Cross-Section Estimates

Given the foregoing evidence on the variation of beta around splits, it is of interest to characterize more precisely the time-series behavior of the average beta, and for this purpose we use the following cross-section procedure, which is

Table I

Mean Time-Series Beta Estimates around Stock Split Announcements and Ex-Dates (Standard Errors in Parentheses)

	Estimator		
Interval	OLS	3-Day	5-Day
Pre-Announcement	1.04	1.69	1.70
	(0.03)	(0.05)	(0.07)
Announcement	1.04	1.74	1.81
	(0.03)	(0.05)	(0.07)
Post-Ex-Date	1.30	2.19	2.24
	(0.03)	(0.06)	(0.08)

similar to that of Ibbotson [4]. Note that the market-model regression parameters from each security may be written as the sum of the average sample value for a given day and the deviation from the sample value, so that equation (1) may be written as

$$R_{jt} = a_t + b_t R_{mjt} + (a'_{jt} + b'_{jt} R_{mjt}) + e_{jt}, \tag{2}$$

where a_t and b_t denote the sample average values for day t and the primed variables denote deviations from the sample averages. Now consider the cross-section regression for day t:

$$R_{jt} = a_t + b_t R_{mjt} + u_{jt}. \tag{3}$$

Comparing (2) and (3), it may be verified that $\text{cov}(u_{jt}, R_{mjt}) = 0$ so that the regression (3) provides an unbiased estimate of the average beta coefficient on day t. For both split announcements and split ex-dates, regression (3) was estimated daily for seventy-five trading days before and after the event, a similar window having been used by Ohlson and Penman [6]. To allow for possible infrequent trading effects, three- and five-day estimators were also constructed using the lagged and anticipated market return as described above. The results are reported in Tables II and III.

Table II

Mean Cross-Section Beta Estimates around Stock Split Announcements (Standard Errors in Parentheses)

	Estimator		
Days	OLS	3-Day	5-Day
(−75, −3)	0.95	1.68	1.83
	(0.01)	(0.03)	(0.04)
(−2, +2)	1.14	2.10	2.41
	(0.07)	(0.13)	(0.21)
(+3, +75)	1.05	1.88	2.03
	(0.01)	(0.03)	(0.04)
Announcement	1.26	2.13	2.43

Table III

Mean Cross-Section Beta Estimates around Stock Split Ex-Dates (Standard Errors in Parentheses)

	Estimator		
Days	OLS	3-Day	5-Day
(−75, −3)	0.99	1.77	1.95
	(0.01)	(0.03)	(0.03)
(−2, +2)	1.29	2.32	2.60
	(0.13)	(0.22)	(0.32)
(+3, +75)	1.17	2.12	2.33
	(0.02)	(0.04)	(0.05)
Ex-Date	1.76	2.48	3.84

Table II reveals a slight tendency for the average beta to increase over the period surrounding the split announcement. However, the seventy-five-day window typically encompasses the ex-date, after which we know there is a tendency for the beta to increase. On the other hand, there is a marked increase in the average beta during the days immediately around the announcement. While the average beta is 0.95 in the seventy-five-day window preceding the announcement, it is 1.36 on the day before the announcement date and 1.26 on the announcement date itself, which is higher than on any of the preceding days; the t-statistic for the difference between the average OLS beta for the five days surrounding the announcement and the average value for the preceding thirty-six days is 2.5, which is significant under the usual criteria. The three- and five-day estimators show increases around the announcement date that are almost exactly proportional to that of the OLS estimator, so that it seems that the temporary risk shift we identify is a real phenomenon and not the product of measurement problems. While it is not surprising that the variance of returns should be higher on the announcement date, it is surprising to find that there is a transient increase in systematic risk since a split announcement would generally be thought of as conveying firm-specific rather than economy-wide information.

The corresponding results for the split ex-date are presented in Table III. Just as on the announcement date itself, all three estimators identify a major increase in the beta on the ex-date; for the five days around the ex-date, the increase is of the order of thirty percent and is highly significant according to a standard t-test. In fact, the increase in beta is highly concentrated on the ex-date itself and the following day. Contrary to the findings for the announcement date, there appears to be a permanent increase in the average beta after the ex-date; for all three estimators, the increase is highly significant and is of the order of twenty percent. While the individual daily estimates are noisy, there is no visible trend in the average beta over the following seventy-five days. In fact, the average beta for days seventy-six through 225 remains about ten percent above the pre-split level, the difference being highly significant. Again, the fact that the three estimators yield parallel results suggests that the findings are not due to changing trading frequency.

III. Conclusion

We have identified a temporary increase in the average beta of stocks on both the split-announcement date and the date the split becomes effective; we also found a permanent increase in the beta following the ex-date. These results are not consistent with received theory, according to which the split announcement would constitute firm-specific information and the split itself would have no effect on the risk of the stock. The results, however, are consistent with the earlier puzzling findings of Ohlson and Penman and of Dravid. They are also consistent with the finding by Kalay and Loewenstein [5] that the systematic risk of a sample of stocks increased from 0.81 to 0.90 on the two days around a dividend announcement. None of the statistical problems discussed by Ohlson and Penman would seem to explain the results, and we have no explanation for them at present. It would be of interest to determine whether, in addition to

stock splits and dividend announcements, other events that are generally thought of as firm specific are also associated with increases in systematic risk.

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