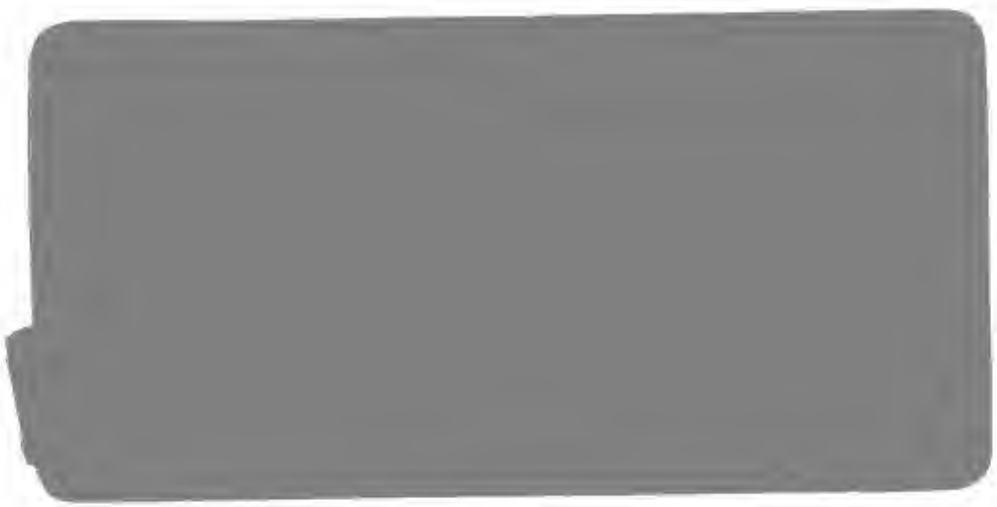
Faculty Working Papers

PRICE VOLATILITY AND PRICE LEVEL

Frank K. Reilly, Professor of Finance
Eugene F. Drzycimski, University of Wisconsin
at Oshkosh

#505

College of Commerce and Business Administration
University of Illinois at Urbana-Champaign



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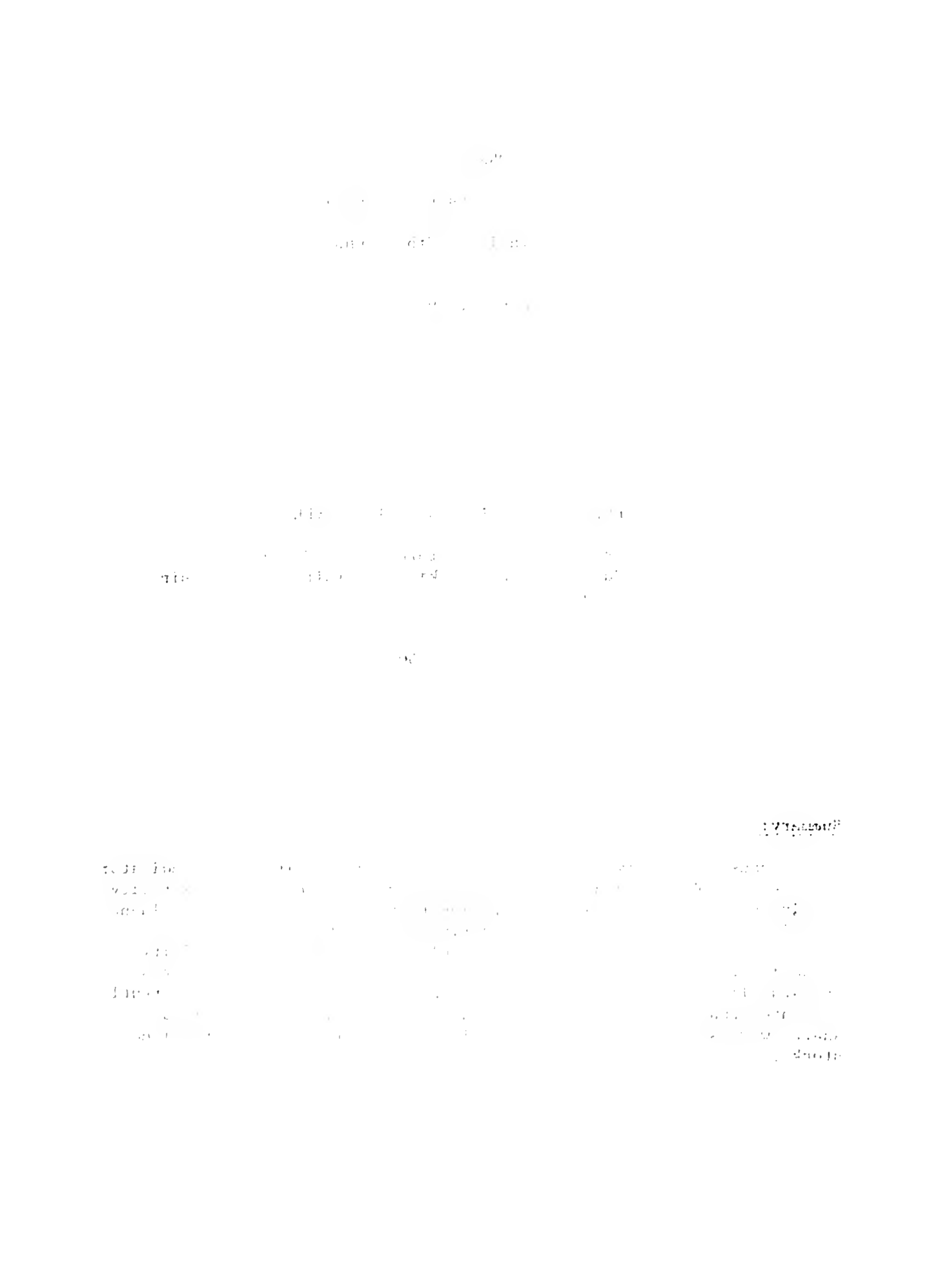
Summary:

Because of the importance of stock price volatility as an indicator of risk, a number of studies have examined what causes price volatility for individual stocks. Several studies that have examined the influence of price level on volatility have derived conflicting results. This study examines the impact of price level by examining the volatility of a sample of stocks before and after a two-for-one split that assures the stability of the risk for the two samples. The results consistently indicated that the price level did make a difference--lower priced shares were significantly more volatile than comparable higher priced stocks.



PRICE VOLATILITY AND PRICE LEVEL*

Frank K. Reilly
Eugene F. Drzycimski**

INTRODUCTION

Because of the importance of stock price variability as an indicator of risk, a number of studies have investigated what influences the variability in prices for alternative stocks. One factor that has been investigated is the influence of price level, but the results have generated mixed conclusions. Specifically, several authors have contended that stocks with relatively low price levels are more volatile than comparable securities with higher prices while other investigators have contended that price level in and of itself should have no influence on price variability, because the internal characteristics of the firm should be the determining factor. A problem with all prior studies has been the requirement to hold risk constant during an investigation. Specifically, the question arises whether low price securities are also high risk securities and whether this risk differential is what influences the results. The current study attempts to solve this problem by considering the change in price volatility for a sample of stocks before and after a two-for-one split. Specifically, we examine the price variability for a group of stocks before they split and

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the same sample of stocks during a period after the stock split. This sample then should provide relatively constant risk during the two time periods.

The first section discusses prior studies concerned with price variability and price level. In the second section we discuss the test design and the hypothesis. Section three considers the test procedure including the sample of stocks, and the sample time period. In the fourth section the results are presented and discussed. The final section contains a conclusion and a discussion of the implication of these results.

PRIOR RESEARCH ON PRICE AND VOLATILITY

The initial study on whether low-price stocks are more volatile than high-price stocks was by Louis Fritzemeier.[1] Fritzemeier analyzed fluctuations, movements, and leads and lags of computed indexes of groups of ten stocks falling within each of six price groups (under $10 to over $100) taken from each of four lower grade (Ca, Caa, B, Ba) categories off the NYSE as rated by Moody's for the 1926-1935 period. Both weekly and monthly closing prices were indexed. Indexes were analyzed by a simple plotting on logarithmic graph paper.

Fritzemeier felt that his study identified the following relationships between stock price level and volatility:

1) Low-price stocks were more volatile than high-price stocks

2) Low-price stocks tend to outperform high-price stocks in both bull and bear markets, and

3) Neither low-price nor high-price stocks seem to lead or lag the general market movement.

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[1]Louis H. Fritzemeier, "Relative Price Fluctuations of Industrial Stocks in Different Price Groups," Journal of Business, Vol. 9, No. 2 (April, 1936).

There were several methodological questions on the study. Specifically, stocks were grouped by prices rather than examining individual stocks. Also, the sample was badly skewed toward high risk securities and quality variables within grades were ignored. Finally, it was a rather unique time period.

In 1951 John Clendenin challenged the Fritzmeier results.[2] Using monthly spot prices for an unspecified number of stocks Clendenin related the range to the mean price for the period 1937-1944, the years 1946 and 1948, and November 1948. He concluded that the variability of stock price was not a function of the level of price, but rather a function of stock quality.

In 1966 Heins and Allison examined forty-eight A rated stocks and sixty-two B rated stocks. They used the range/mean as a measure of volatility and regressed it against average price, earnings variability, price-earnings relative, trading turnover, and exchange listing for the year 1959. Because the coefficients for the average stock price variable were very low the authors concluded that price variability was not related to stock price. Unfortunately, the total multiple regression equation explained little of the relative price variability. This may be because market performance was ignored or because all micro factors contributing to risk were assumed to be incorporated into the stock ratings.

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[2]John C. Clendenin, "Quality Versus Price As Factors Influencing Common Stock Price Fluctuations," Journal of Finance, Vol. 4, No. 5 (December, 1951), pp. 398-405.

[3]James A. Heins and Stephen L. Allison, "Some Factors Affecting Stock Price Variability," Journal of Business, Vol. 39, No. 1 (January, 1966), pp. 19-23.

Altman and Schwartz recognized that the "volatility of price movements" is ambiguous so they attempted a definition, studied the stability of volatility over time, separated stock volatility into its unique and market-related components, and into its long-run and short-run fluctuations.[4] Two basic price volatility models were formulated to examine weekly closing prices for 20 stocks randomly selected from the S & P 500 for the period 1962-1968. Based upon their results, they cautioned against trying to categorize stocks as either price-volatile or stable because volatility measures are themselves volatile.

Subsequently, Haugen accepted the concept of differing price variability and attempted to identify characteristics unique to volatile issues.[5] It was hypothesized that price variability was an inverse function of the spread between expected rate of growth in dividends and the rate of return required by investors. The analysis examined 475 industrial companies during the 1948-1967 period. Frequency of stock price observations was not specified. The dependent variable was defined in two ways: the coefficient of variation of stock prices and the standard error of the regression of price on time divided by the mean price. In both forms of the regression the mean price per share was a significant determinant of price variability. Haugen concluded that the market for common stocks is sufficiently imperfect to cause low-price stocks to trade with more variability than high-price stocks all else being equal.

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[4]Edward I. Altman and Robert A. Schwartz, "Common Stock Price Volatility: Measures and Patterns," Journal of Financial and Quantitative Analysis, Vol. 5, No. 1 (January, 1970), pp. 603-625.

[5]Robert A. Haugen, "Expected Growth, Required Return, and the Variability of Stock Prices," Journal of Financial and Quantitative Analysis, Vol. 5, No. 4 (September, 1970), pp. 297-307.

Because prior work indicated that more than fifty percent of price variability stems from the firm effect, Klemkosky and Petty tried to discern what causes price variability by applying multiple discriminant analyses to numerous firm-unique variables.[6] Thursday closing prices for a sample of 160 industrial stocks traded on the NYSE for 1971 were obtained. These stocks were grouped into quartiles according to price variability as measured by their coefficients of variation. Various investment data were gathered including measures of financial risk, fixed charge coverage, growth in price and earnings, variability of earnings and dividends, price relatives, dividend yield, supply of stock, stock turnover, and the average price per share. Equivalent data for a hold-out sample of ninety stocks was also gathered.

The results strongly supported the notion that low-price stocks are more volatile than high-price stocks. Two variables, turnover and average price, classify both samples about as well as did all eleven variables.

Clearly, prior studies have produced opposing results. Apparently there is a possibility that a market imperfection exists which causes low-price stocks to evidence greater volatility than high-price stocks.

TEST DESIGN AND HYPOTHESIS

Justification of Test Design

Prior studies have examined differences in the volatility for a sample of stocks that had differences in price level, but also major differences in risk. To pinpoint the effect of price level on volatility the general

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[6] Robert C. Klemkosky and William J. Petty, "A Multivariate Analysis of Stock Prices," Journal of Financial and Quantitative Analysis, Vol. 1, No. 1 (Summer, 1973), pp. 1-10.

approach was to include specific measures for other variables that might effect price volatility and also a price level variable. The intent was to hold these other variables constant (including risk), and determine if price level had an independent effect. In our research design where we examine price volatility before and after a stock split, all the "other variables" are held constant because the basic nature of the company is generally constant during the total test period of about one year. Obvious examples of no change would be such variables as the debt/equity ratio, fixed charge coverage, EPS volatility or growth, and the P/E ratio. None of these characteristics should change because the companies are the same and such variables typically do not fluctuate significantly during such a short time interval.

Further, it is notable that the variables that might change during the two test periods would favor a decline in price volatility. Specifically, prior research has indicated that firms that split tend to increase their dividend.[7] Hence, one might expect an increase in the dividend yield after the split. Several prior studies have indicated a negative relationship between dividend yield and price volatility because of the predictability of return from dividends as contrasted to price appreciation.[8] Therefore, this tendency toward an increase in dividend yield would favor a decline in stock price volatility.

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[7]Eugene F. Fama, L. Fisher, M. Jensen, and R. Roll, "The Adjustment of Stock Prices to New Information," International Economic Review, Vol. 10, No. 1 (February, 1969), pp. 1-21.

[8]Burton G. Malkiel, "Equity Yields, Growth, and the Structure of Share Prices," The American Economic Review, Vol. 53, No. 5 (December, 1963), pp. 1004-1031.

Several studies have likewise indicated a general negative relationship between price volatility and the number of shares outstanding. One may question whether shares outstanding is a proxy for size, but obviously in the current study there has generally been a doubling of the number of shares outstanding. Therefore, if there is a bias, it would be toward a decline in volatility because of the significant increase in shares outstanding.

Finally, annual trading turnover has consistently been shown to have a significant effect on absolute price volatility and even relative volatility (beta).[9] Specifically, studies have consistently found a significant positive relationship between trading turnover and stock price volatility. Our results indicated that although the absolute amount of trading increased after the split, the trading did not increase by a factor of two.[10] Therefore, the relative amount of trading (i.e., trading turnover) did not increase, but actually tended to decline slightly after a stock split. This decline in trading turnover would tend to indicate the possibility of a small decline in price volatility.

In summary, because of the test design almost all of the internal risk characteristics of the sample firms are, by definition, constant so should not influence the price volatility for the two samples of stocks. The variables that do change (shares outstanding), or could change (dividend yield and trading turnover), would favor a decline in price volatility.

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[9]Barr Rosenberg and James Guy, "Prediction of Beta from Investment Fundamentals," Financial Analysts Journal, Vol. 32, No. 3 (May-June, 1976), pp. 60-72.

[10]The average trading during the 25 week pre-split period was 404.34; the average during the post-split period was 653.08, an increase of 61.5 percent.

Statement of Hypothesis

Based upon the belief in efficient capital markets and the prior discussion of test design it is hypothesized that there will not be a significant difference in the price volatility for the two samples of stocks with significantly different price level. Put another way, it is hypothesized that price level does not affect price volatility.

TEST PROCEDURE

Sample of Stocks

The sample is composed of a number of common stocks listed on the New York Stock Exchange that split two-for-one during the period 1964-1976. The two-for-one split criteria was stipulated to ensure a major price change.[11] For each of the 13 years, ten stocks were randomly selected from the list of stocks that split two-for-one. Therefore, the final sample was 130 stocks. A list of the stocks for each year is available from the authors.

Sample Period

The sample period for the analysis of each of the sample stocks was specified to avoid as much as possible any abnormal price movements involved in the split itself. Specifically, several studies have examined price movements for split stocks for various periods immediately surrounding the time of the split as a test of the efficient market. In the current study we want to avoid this period immediately surrounding the split in

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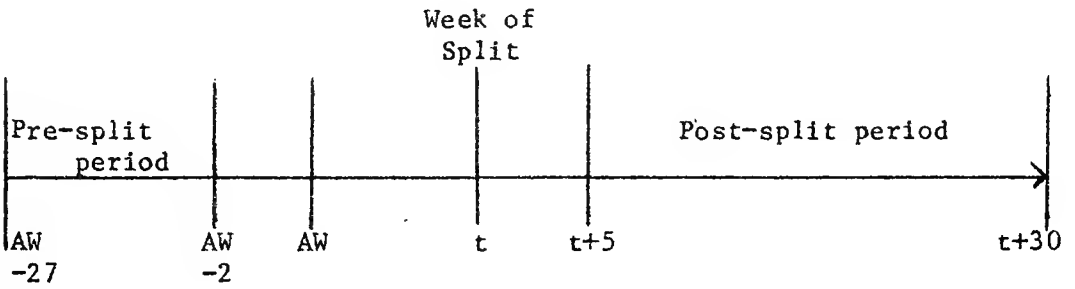
[11] The average price for the sample during the last two weeks of the pre-split period was $62.98; the average price during the first two weeks of the post-split period was $31.60. This represents a difference of 49.8 percent.

order to measure the "normal" price volatility of the stocks involved. Some may feel that a longer period surrounding the split should have been avoided and we might agree except for the offsetting problem of changing risk. A major advantage of our sample is constant risk, but the longer the time interval separating the pre- and post-split periods, the greater the probability of a change in risk.

The pre-split analysis period begins two weeks prior to the week of the announcement and extends for 25 weeks. The post-split period begins five weeks after the week of the split (t+5) and extends for 25 weeks beyond this to week t+30. The following schematic drawing indicates the period of analysis.



AW - Announcement Week

Measures of Stock Price Volatility

The price volatility is examined using the following measures of variability during the two time periods. The analysis examines the weekly percent price change during each of the two 25 week periods.

1. Mean percent price change without sign
2. Standard deviation of the percent price change including sign
3. Standard deviation of the percent price change without sign
4. Semi-standard deviation of the percent price change
5. Mean absolute deviation from the mean price change
6. Mean absolute deviation from the median price change
7. The systematic risk relative to the aggregate market (beta)

In addition to an absolute value for each measure, there is a relative value for each of the first six measures--relative to the aggregate market.[12] Specifically, for each of the first six measures we computed a similar measure for the aggregate market, as represented by the S & P 500, for the same time period and derive a ratio of the stock's volatility measure to the market's volatility measure. Therefore, for each stock there are 13 volatility measures for the pre-split period and 13 volatility measures for the post-split period.

The first three measures are all relatively standard with the exception that in two instances the sign of the price change is ignored because our prime concern is with the amount of price volatility not the direction of change. The fourth measure is similar to the second and third except that it only considers price changes below the mean based upon the belief that these are the price changes of interest to risk averse investors--i.e., downside risk is the relevant concern.[13] The fifth and sixth measures are prompted by the extensive literature that indicates that stock price changes may not be normally distributed, and in fact may be part of a family of distributions with infinite variance.[14] Given this possibility

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[12] It is not necessary to derive a relative measure for beta since it is by definition a relative measure.

[13] This measure is discussed and defined in, Harry M. Markowitz, Portfolio Selection (New Yorks John Wiley & Sons, Inc., 1959), Chapter 9; and Jack C. Francis and Stephen H. Archer, Portfolio Analysis (Englewood Cliffs, N.J.: Prentice-Hall Inc., 1971), pp. 14-16.

[14] Benoit Mandelbrot, "The Variation of Certain Speculative Prices," The Journal of Business, Vol. 36, No. 4 (October, 1963), pp. 394-419; and Benoit Mandelbrot, "The Variation of Some Other Speculative Prices," The Journal of Business, Vol. 40, No. 4 (October, 1967), pp. 393-413; Eugene F. Fama, "The Behavior of Stock Market Prices," The Journal of Business, Vol. 38, No. 1 (January, 1965), pp. 39-105.

mean absolute deviation measures have been suggested by Fama as meaningful.[15] The fifth measure calculates the absolute deviations from the mean, while the sixth measure determines absolute deviations from the median which may be a more acceptable measure of central tendency for a non-normal distribution.[16]

Comparisons of Variability

Given the calculations there will be 13 measures of volatility for each of the 130 stocks for the pre-split period and the post-split period. The analysis initially considers what happened to each of the stocks for each measure. Specifically, how many of the stocks experienced an increase or decrease in volatility pre-split versus post-split for each of the 13 measures. Based upon the hypothesis, one would not expect any deviation from half in the number that experience an increase or decrease.

In addition, there is an analysis of the total sample in terms of the 13 measures before and after the split. Given the characteristics of the 13 distributions there is a test of the hypothesis that the distributions are similar before and after the split.

PRESENTATION OF RESULTS

Individual Stocks

For each stock there was a ratio of the variability measure after the split, to the variability measure before the split. A ratio greater

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[15] Bank Administration Institute, Measuring the Investment Performance of Pension Funds for the Purpose of Inter-Fund Comparison (Part Ridge, Illinois: Bank Administration Institute, 1968).

[16] For a further discussion of this see, William F. Sharpe, "Mean-Absolute Deviation Characteristic Lines for Securities and Portfolios," Management Science, Vol. 18, No. 2 (October, 1971).

than 1.0 means the variability for this stock based upon this measure increased after the split. Table 1 contains the 13 variability measures and the number of stocks where the variability increased and the number where it decreased. Using a chi-square test there is an indication whether the proportion is significantly different from 50 percent.

These results indicate that for all of the 13 measures a majority of the stocks experienced an increase in volatility after the split. More important, nine of the 13 differences were statistically significant. This would constitute evidence against the hypothesis of no change in volatility.

Regarding how many of the increases or decreases were significant, it is generally not possible to determine significant differences for many of the volatility measures because of the lack of formal tests. An intuitive rule-of-thumb might be that a change of 100 percent is significant which is a ratio of 2.0 or more. Alternatively a decline of 50 percent might be considered significant (i.e., a ratio of .5 or lower). The results using these rules of thumb are contained in the last two columns of Table 1. Again, typically more stocks experienced significant increases than significant declines, but none of the numbers are very large. On average about 15 of 130 stocks experienced a significant increase.

It is possible to use an F-Test to determine if there is a significant difference in the variance for two independent samples.[17] Obviously in the present study the samples are clearly not independent so the test is not legitimate. Still, if such a test were appropriate the required

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[17]For a discussion of this test see, Ya-lun Chou, Statistical Analysis, 2nd ed. (New York: Holt, Rinehart and Winston, 1975), pp. 325-327.

ratio for a significant change would be approximately two (1.98). Therefore, about 18 of the 130 changes in variance would have been considered significant.

Table 2 contains the mean of the 130 company ratios for each of the 13 variables. As shown, all the average ratios are greater than one which confirms the prior results that on average the increases were larger and more frequent than the decreases. We tested whether these average ratios are significantly larger than one and the test results are contained in Table 2. As shown, all the average ratios except one (Beta) are significantly greater than one. These results indicate that there is a significant difference in the number of stocks that experienced an increase in volatility, and a significant difference in the size of the increase as reflected in the ratio.

These overall results for individual stocks provide consistent evidence against the hypothesis. Regarding the number of stocks experiencing an increase in volatility versus a decrease, the results indicate a significant difference between high and low priced stocks which would not support the hypothesis. In addition, the average of all the ratios were larger than one and almost all of them were significantly larger which indicates the size of the increases were substantial on average compared to the declines.

Total Sample Results

Table 3 contains the characteristics of the 26 variable distributions. The first 13 are the volatility measures before the split, the last 13 are the same variables for after the split.

These data indicate a wide range of values for the variables and also indicates that many of the distributions have significant positive skewness

and kurtosis. The relative variability of the distributions as measured by the coefficient of variation (CV) indicated that for all measures except the distribution of betas the CV's were larger after the split than before. All the skewness and kurtosis measures were smaller for the pre-split distributions.

Comparisons of Means

Table 4 contains the results of a test of the means for the alternative distributions of volatility measures for the high and low priced stocks. The hypothesis would imply no significant difference in the mean volatility measures.

Notably, in 12 of the 13 comparisons the mean value for the distribution of the volatility measure was larger after the split than before. More important for the hypothesis, if the critical value was set at .05, five of the means were significantly different for the high priced versus the low priced securities. Increasing the critical value to .10 added another measure.[18]

In summary, the comparison of means likewise does not support the hypothesis of equal volatility for high priced stocks versus low priced stocks, but probably could not be considered strong evidence against the hypothesis. Although most of the means were higher for the low priced group, only five of the differences were statistically significant.

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[18]For a test of means with samples that are not independent see, William L. Hays and Robert L. Winkler, Statistics (New York: Holt, Rinehart and Winston, 1971), pp. 425-430.

SUMMARY AND CONCLUSION

Summary

Because of the importance of stock price volatility to the measurement of risk a number of studies have examined what factors influence the variability for individual stocks. One particular factor, price level has experienced a checkered career because the folklore has tended to suggest that low priced stocks are more volatile in contrast to almost all economic and financial theory that would suggest that price level adjusted for risk differences should not have any effect on volatility.

To test the effect of price level on price volatility this study examined the volatility for a number of stocks before and after a two-for-one stock split. Such a research design provides a sample of stocks that is naturally adjusted for risk differences. Based upon a belief in an efficient capital market it was hypothesized that there should be no difference in the price volatility for the high priced stocks (before the split) and the low priced stocks (after the split).

The results "on balance" did not support the hypothesis of equal price volatility for the two samples. Specifically, the number of stocks that experienced increases in volatility was significantly larger than 50 percent. The ratios of the volatity measures for the low priced versus high priced stocks indicated that the mean of the ratios for all 13 measures were above 1.0 which indicates that the volatility measures were consistently higher for the low priced stocks. All the means except one were significantly greater than one at the .05 level. Finally, an analysis of the means for the 13 distributions of volatility measures

showed that almost all of the means increased for the low priced stocks, but only five of the differences were statistically significant.

Conclusion

These study results support the notion that price level adjusted for risk differences does affect the price volatility of common stocks. Beyond the basic results, one should recall the observation that even with the matched pair sampling there was a possible bias in favor of a decrease in volatility because of an increase in the dividend yield, more shares outstanding, and a decrease in trading turnover.

TABLE 1

NUMBER OF STOCKS THAT EXPERIENCED INCREASES
OR DECREASES IN VOLATILITY MEASURES

Measure	No. of Increases	No. of Decreases	Significant Difference	No. 2.0 or above	No. 0.5 or below
Mean P.C. Change	83	47	Yes	15	3
S.D. w/o sign	80	50	Yes	18	5
S.D. with sign	84	46	Yes	18	4
Semi-Std. Dev.	84	46	Yes	17	4
MAD 1 (Mean)	82	48	Yes	19	2
MAD 2 (Median)	83	47	Yes	20	2
Beta	75	55	No	28	27
Rel. Mean Change	79	51	Yes	8	8
Rel. S.D. w/o sign	81	49	Yes	15	13
Rel. S.D. with sign	71	59	No	10	11
Rel. Semi S.D.	79	51	Yes	10	10
Rel. MAD 1	75	55	No	11	8
Rel. MAD 2	76	54	No	10	9

TABLE 2

RESULTS FOR TEST OF MEANS FROM DISTRIBUTIONS OF
RATIO FOR INDIVIDUAL STOCKS BEFORE AND AFTER SPLIT

Measure	Mean Ratio	Std. Dev. of Ratio	T-Value
1. Mean Absolute Change	1.3358	0.7082	5.41
2. Std. Dev. w/o sign	1.4116	1.0518	4.46
3. Std. Dev. with sign	1.4567	1.3604	3.83
4. Semi-Std. Dev.	1.4449	1.3517	3.75
5. MAD 1 (Mean)	1.4492	1.2540	4.08
6. MAD 2 (Median)	1.4489	1.2560	4.07
7. Beta	2.0063	10.6894	1.07
8. Rel. Mean Abs. Change	1.1881	0.5434	3.95
9. Rel. Std. Dev. w/o sign	1.2569	0.8820	3.32
10. Rel. Std. Dev. with sign	1.2722	0.9714	3.19
11. Rel. Semi-Std. Dev.	1.2857	1.0074	3.23
12. Rel. MAD 1	1.2528	0.8503	3.39
13. Rel. MAD 2	1.2555	0.8479	3.44

TABLE 3

CHARACTERISTICS OF THE DISTRIBUTIONS FOR THE
26 VOLATILITY MEASURES
(FIRST 13 VARIABLES BEFORE THE SPLIT; LAST 13 AFTER THE SPLIT)

	Mean	Std. Dev.	Min.	Max.	Range / Mean	Skewness	Kurtosis
1. Mean Absolute Change	.0316	.0127	.0053	.0711	2.085	0.824	0.574
2. Std. Dev. w/o sign	.0281	.0172	.0039	.1323	4.568	2.973	13.279
3. Std. Dev. with sign	.0417	.0202	.0039	.1455	3.393	1.791	5.950
4. Semi-Std. Dev.	.0281	.0167	.0027	.1337	5.45	3.224	15.803
5. MAD 1 (Mean)	.0309	.0129	.0032	.0683	2.107	0.686	0.515
6. MAD 2 (Median)	.0304	.0125	.0032	.0653	2.047	0.641	0.438
7. Beta	.9762	.7923	-1.6680	3.7015	4.663	0.247	1.427
8. Relative Mean Absolute Change	2.497	1.027	0.477	7.472	2.801	1.232	3.348
9. Rel. Std. Dev. w/o sign	2.919	1.601	0.534	9.440	3.051	1.585	3.446
10. Rel. Std. Dev. with sign	2.621	1.219	0.319	9.446	3.482	1.767	7.093
11. Rel. Semi Std. Dev.	2.485	1.217	0.302	8.687	3.375	2.081	7.767
12. Rel. MAD 1	2.535	1.139	0.330	8.788	3.337	1.533	6.055
13. Rel. MAD 2	2.522	1.123	0.326	8.698	3.320	1.519	6.067
1. Mean Absolute Change	.0375	.0150	0.0133	.0877	2.013	1.506	2.409
2. Std. Dev. w/o sign	.0312	.0126	.0121	.0811	2.214	1.592	3.086
3. Std. Dev. with sign	.0487	.0192	.0181	.1193	2.076	1.565	2.745
4. Semi-Std. Dev.	.0318	.0125	.0140	.0774	1.997	1.639	3.059
5. MAD 1 (Mean)	.0370	.0147	.0130	.0889	2.051	1.535	2.662
6. MAD 2 (Median)	.0364	.0144	.0125	.0882	2.080	1.504	2.517
7. Beta	.9756	.9866	-5.9770	3.1205	9.345	-3.211	20.677
8. Rel. Mean Abs. Change	2.690	1.185	0.997	8.943	2.954	2.530	9.220
9. Rel. Std. Dev. w/o sign	2.966	1.796	0.893	15.614	4.963	3.983	22.810
10. Rel. Std. Dev. with sign	2.804	1.510	1.059	12.053	3.921	3.701	18.819
11. Rel. Semi-Std. Dev.	2.635	1.249	1.015	10.785	3.708	3.153	15.932
12. Rel. MAD 1	2.716	1.304	0.971	10.589	3.541	3.137	14.151
13. Rel. MAD 2	2.712	1.266	0.990	10.517	3.513	2.976	13.408

TABLE 4

RESULTS FOR THE TEST OF MEANS FROM DISTRIBUTIONS
OF VOLATILITY MEASURES BEFORE AND AFTER STOCK SPLIT

Measure	Mean Before Split	Mean After Split	T-Value	Probability
1. Mean Absolute Change	.0316	.0375	3.42*	.001
2. Std. Dev. w/o sign	.0281	.0312	1.66	.098
3. Std. Dev. with sign	.0417	.0487	2.86*	.007
4. Semi-St. Dev.	.0281	.0318	2.02*	.047
5. MAD 1 (Mean)	.0309	.0370	3.56*	.001
6. MAD 2 (Median)	.0304	.0364	3.59*	.001
7. Beta	.9762	.9756	0.01	.992
8. Rel. Mean Abs. Change	2.497	2.690	1.40	.169
9. Rel. Std. Dev. w/o sign	2.919	2.966	0.22	.826
10. Rel. Std. Dev. with sign	2.621	2.804	1.08	.284
11. Rel. Semi-Std. Dev.	2.485	2.635	0.98	.331
12. Rel. MAD 1	2.535	2.716	1.19	.240
13. Rel. MAD 2	2.522	2.712	1.28	.204