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THE EFFECT OF STOCK SPLITS AND STOCK DIVIDENDS ON THE MONTHLY PRICE RELATIVES OF COMMON STOCKS

The effect of splits and stock dividends on the market price of common stocks continues to be a controversial theme in finance. This study examined information affecting the price behavior of stocks that is implied by the announcement and processing of splits and stock dividends. In addition, the informational content regarding the market period, size of distribution, and terminology used to describe the distribution was also studied.

A stepwise regression procedure was used to adjust the monthly price changes of a sample of stock splits and stock dividends. These monthly price changes were adjusted for dividends, earnings, specific industry and general stock market prices with the following regression model:

$$\ln \frac{P_{jt}}{P_{jt-1}} = B_1 + B_2 \ln \frac{D_{jt}}{D_{jt-1}} + B_3 \ln \frac{E_{jt}}{E_{jt-1}} + B_4 \ln \frac{I_{jt}}{I_{jt-1}} +$$

$$B_5 \ln \frac{M_t}{M_{t-1}} + U_{jt}$$

The adjusted monthly price relatives are represented by the U_{jt}. The Kolmogorov-Smirnov and Tippett tests of normality indicated that these adjusted price changes were not normally distributed. Therefore, the nonparametric Kruskal-Wallis H statistic was used to make various comparisons.

Several areas were considered concerning information potential for the investor. In particular, the study has shown that: (1) price behavior attending stock-split and stock-dividend securities is different from the price behavior of securities which are not associated with new stock distributions; (2) price behavior of new-distribution stock differs according to the type of market period (i.e., bull, bear and no-change) in which the distribution occurs; specifically, the most favorable price action occurs during the no-change period; (3) price behavior attending new stock distributions described as "stock dividends" is more favorable than price behavior for distributions described as "stock splits," and (4) the size of the stock distribution has an effect on stock price behavior.

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THE EFFECT OF STOCK SPLITS AND STOCK DIVIDENDS ON THE MONTHLY PRICE RELATIVES OF COMMON STOCKS

INTRODUCTION

The effect of stock splits and stock dividends on the market price of common stocks continues to be a controversial theme in finance. On the one hand, some scholars suggest that stock splits and stock dividends alone are important causes of changes in the behavior of stock prices. On the other hand, other scholars suggest that new stock distributions simply imply information about other fundamental variables, such as dividends and earnings, and, accordingly, price action in a new distribution security is attributable to expected changes in these variables and not to the stock distributions *per se*.

Stock dividends and stock splits do not affect the total assets or the earning ability of the existing assets, nor do they affect the total debt or equity or the debt-to-equity ratio. Thus, no valid reason appears to exist for the market value of the firm to be influenced solely by a stock split or stock dividend. Historical evidence, however, indicates that common stocks associated with splits and stock dividends do experience price increases during the period preceeding the distribution. Price action after the distribution date is somewhat less predictable with prices continuing to increase in some cases, and declining or remaining constant in others.

Explanations of the price actions attending stock splits and stock dividends have been conflicting. Some studies have indicated that the split or stock dividend itself can explain the price changes.[1] Other studies have concluded that the explanation rests in more fundamental factors, such as earnings and/or dividends.[2]

A review of precisely what happens from an accounting point of view, when a firm has a stock split or stock dividend, is illustrated by the sequence of capital structures below:

XYZ CORPORATION

		Long-Term Debt	50,000
		Preferred Stock	25,000
		Common Stock (1500 shares -- $100 par)	150,000
		Retained Earnings	175,000
Total Assets	400,000	Total Equities	400,000

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[1] Keith Johnson, "Stock Splits and Price Changes," Journal of Finance, XXI (December, 1966), 675-86.

Peter Kimball and Robert Papera, "Effect of Stock Splits on Short-Term Market Prices," Financial Analysts Journal, XX (May-June, 1964), 75-80.

Richard Sussman, The Stock Dividend (University of Michigan, Ann Arbor, Michigan: Bureau of Business Research, 1962).

[2] C. Austin Barker, "Effective Stock Splits," Harvard Business Review, XXIV (January-February, 1965), 101-06.

C. Austin Barker, "Stock Splits in a Bull Market," ibid., XXXV (May-June, 1957), 72-79.

C. Austin Barker, "Evaluation of Stock Dividends," ibid., XXXVI (July-August, 1958), 99-113.

Eugene Fama, et al., "The Adjustment of Stock Prices to New Information," International Economic Review, X (February, 1969), 1-21.

A stock split of two-for-one would result in the following changes: The new par value would be $50.00, and the number of shares would be 3,000. All other accounts would remain constant. The new statement would appear as follows:

XYZ CORPORATION

		Long-Term Debt	50,000
		Preferred Stock	25,000
		Common Stock (3000 shares -- $50 par)	150,000
		Retained Earnings	175,000
Total Assets	400,000	Total Equities	400,000

This example presents no clear-cut explanation as to why the total value of the firm should be positively affected by the stock split. The assets are the same; consequently, production efficiency has not been affected. The long-term debt and its interest charge, along with the preferred stock and its dividend, have not been affected. Hence, the cost of trading on the equity, i.e., the finance cost, has not changed. Finally, the total equity and pro rata ownership per original shareholder have not changed.

There is little difference between a stock split and a stock dividend. Had XYZ Corporation doubled its shares with a 100 per cent stock dividend instead of the two-for-one split, an amount equivalent to the market value of these new shares would be transferred to the permanent capital of the firm, provided the market price is not less than the par value.

For cases in which the market price is less than the par value, an amount equivalent to the number of new shares times the par value is transferred from retained earnings. For example, if the market price of the stock was $90, a transfer of $100 times 1,500 shares, i.e., $150,000, to the common stock account would result. This is illustrated in the following balance sheet:

XYZ CORPORATION

		Long-Term Debt	50,000
		Preferred Stock	25,000
		Common Stock (3000 shares -- $100 par)	300,000
		Retained Earnings	25,000
Total Assets	400,000	Total Equities	400,000

The post-stock-dividend statement also indicates that total assets, total debt, preferred stock, and total equity, along with pro-rata ownership, have remained constant. Again, no particular reason is apparent for any change in the value of the firm.[3]

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[3]Stephen Sosnick points out, in practice the true value of the firm may be slightly negatively affected because of the cost of processing splits and stock dividends. Moreover, the costs of a split or large stock dividend must be amortized for income tax purposes, because the expenditures are considered capital in nature. See "Stock Dividends are Lemons, Not melons," California Management Review, Winter, 1961, p. 63.

Purpose

The foregoing comments suggest that a disagreement currently exists in financial literature concerning the explanation of stock market price behavior associated with stock splits and stock dividends. This study will attempt to determine first, if information about the future price performance of a stock is contained in a stock dividend or stock split, and second, if more detailed knowledge in regard to the market period, size of the new distribution and terminology used to describe the new distribution, offers additional information for explaining the resultant stock prices. More specifically, this study will test the following null hypotheses:

(1) The price behavior of securities that split or processed stock dividends are not different from those of securities which did not process similar distributions, regardless of the market period.

(2) The price behavior of split and stock dividend securities is not different in bear, bull, or no-change markets.

(3) The price behavior of stocks with distributions described as "dividends" is not different from those described as "splits", regardless of the size of the distribution or the accounting procedure employed.

(4) The price behavior of "splits" is not different for various sizes of the new distribution. Specifically, the following groups are examined: (1) six-for-five to less than 1.5-for-one, (2) 1.5-for-one to less than two-for-one, (3) two-for-one, and (4) greater than two-for-one.

(5) The price behavior of "dividends" is not different for various sizes of the distribution. The groupings examined are: (1) 20 per cent to 49 per cent, (2) 50 per cent to 99 per cent, (3) 100 per cent, and (4) greater than 100 per cent.

(6) The price behavior of "splits" is not different from "dividends" of equivalent distribution size. For example, the six-for-five to less than 1.5-for-one stock splits are compared with the 20 per cent to 49 per cent "dividends", the 1.5-for-one to less than two-for-one "splits" are compared with the 50 per cent to 99 per cent "dividends", etc.

Influence of the Market Period

Prior investigations of stock splits and stock dividends suggest that these new distributions are a bullish phenomenom. Several studies have shown that the number of two-for-one stock splits is closely associated with the general level of stock prices.[4] Stock splits tend to occur during rising markets of long duration.[5] Data for the number of stock splits and large stock dividends for the years 1959-1969, together with the average Standard and Poor's Industrial Common Stock Price Index, are presented in Table I and in Graph I. The table and graph show that the number of new distributions varies directly with the level of stock prices. (This information is consistent with management's use of stock splits and large stock dividends to reduce the stock's

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[4]Douglas Bellemore and Lillian Blutcher, "A Study of Stock Splits in the Post War Years," The Analysts Journal, XV (November, 1959), 19-26.

J. C. Dolley has shown that for the 1920's the number of splits is directly related to national income. "Characteristics and Procedures of Common Stock Split-Ups," Harvard Business Review, XI (April, 1933), 316-26.

Fama, et. al., "The Adjustment of Stock Prices to New Information," p. I-21.

[5]Bellemore and Blutcher, "A Study of Stock Splits in the Post War Years," p. 19-26.

price in periods when prices are high.) Clearly, most stock distributions are enacted by managements during periods when prices are high. Whether or not the market generally agrees with this practice, or whether or not more favorable price performance would attend new distributions declared during bear and no-change markets represents an area that has received little attention. The issues will be investigated in this study.

TABLE I

Number of Stock Splits and Stock Dividends Resulting In a Twenty Per Cent or Greater Increase in the Total Shares of New York and American Stock Exchange Stocks and the Average Level of Standard and Poor's Industrial Common Stock Price Index

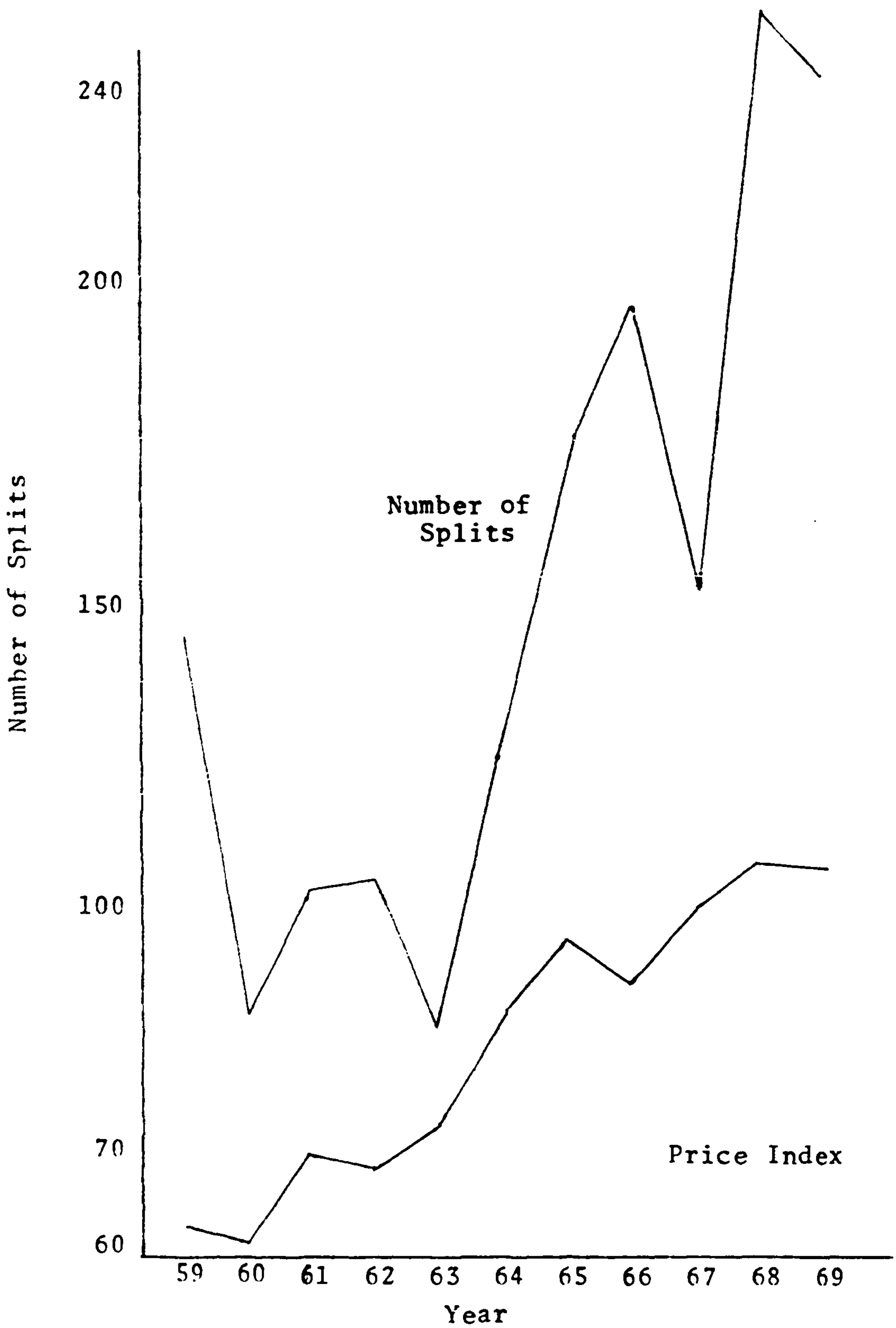
Year	Price Index	Splits
1959	61.45	145
1960	59.43	86
1961	69.99	101
1962	69.54	103
1963	73.79	83
1964	86.19	135
1965	93.48	173
1966	91.08	193
1967	99.18	151
1968	107.49	276
1969	107.13	242

Source: Financial World, (January, 1966-70 eds.) and Standard and Poor's Trade and Security Statistics, (1970 eds.)

Influence of the Size of the Distribution

The American Institute of Certified Public Accountants recommends different accounting treatments for so-called "large"

GRAPH I--Number of Stock Splits and Stock Dividends of Twenty Per Cent and Greater and the Level of Standard and Poor's Common Stock Price Index



and "small" new distributions. For example, the committee has recommended that the stock distributions of less than 20 per cent be accounted for by debiting retained earnings and crediting the capital stock account in the manner described in the previous section concerning the stock dividend distributions of XYZ Corporation. Evidently, the American Institute of Certified Public Accountants believes that without this adjustment to retained earnings and common stock, the per-share dilution of earnings, assets, etc., resulting from such small increases in the number of shares via stock splits and stock dividends might go unnoticed by the investing public. When the number of additional shares is so large that the stock's price immediately reflects this dilution, even to the casual observer, the committee does not consider necessary the capitalization of retained earnings.

The New York Stock Exchange has established for its listed firms certain regulations with respect to stock splits and stock dividends based on these A.I.C.P.A. rulings. Accordingly, the New York Stock Exchange regards all distributions of less than 25 per cent to be stock dividends, and therefore requires appropriate adjustments to the retained earnings and common stock accounts in the same manner as indicated earlier. Further, all new distributions (stock dividends and stock splits) resulting in 100 per cent and greater increases in the outstanding shares are regarded as stock splits; therefore, the par value and number of shares outstanding are the only adjustments made in the balance sheet. New distributions between 25 per cent and 100 per cent are accounted for as stock splits or stock dividends on the basis of the circumstances associated with each case. If the size of the new distribution is an appropriate means of classifying new distributions as stock splits or stock dividends, the market price behavior of the securities should reflect the influence of distribtuion size. Therefore, as mentioned previously, comparisons of the price behavior are made for various new-distribution sizes.

Descriptive Terminology

In addition to considering distribution size, problems may arise from the use of the term "dividend" to describe the issuance of stock. The term "dividend" usually connotes a transfer of current earnings from the firm to the stockholder. In the case of a stock split or stock dividend, since the assets of the firm are not reduced, the investors do not receive a portion of current earnings. If the investing public does in fact interpret a stock dividend to be a real distribution of assets, instead of an accounting change, the market price of the stock should reflect this interpretation.

In the preceeding discussions, illustrations were presented which showed that stock splits and stock dividends had similar affects on the firm. However, if in fact, the term stock "dividend" influences investor evaluation of the firm, the price behavior of securities associated with stock dividends should differ from the price behavior of securities associated with stock splits. As previously mentioned, this study will compare the price behavior of "stock dividend" and "stock split" securities.

Scope

The source, from which the sample of new-distribution stocks was drawn, consisted of new distributions resulting in twenty per cent and greater increases in the number of outstanding shares. Therefore smaller distributions are not included in the study.

Organization of the Study

Chapter II presents a review of the literature pertinent to the problems that are investigated in this paper. The methodologies and conclusions of the various studies are presented together with an evaluation of each.

Chapter III develops the theoretical and statistical model used to analyze price changes. In addition, the various statistical tests utilized in the study are explained.

Chapter IV explains the methods used to gather and interpret the data. The empirical results are also presented.

Chapter V summarizes the study and develops the implications of the test results.

CHAPTER II

PRIOR INVESTIGATIONS

The effect of stock splits and stock dividends on the market price of common stocks has been a source of interest for financial investigators for at least the past forty years.[6] This chapter will discuss the results of those studies considered important for the current study.

Early Studies

J. C. Dolley Study

One of the earliest published studies of the relationship of stock splits and the behavior of market price was that of J. C. Dolley.[7] Dolley studied 95 split cases that split during the period 1921-1930. He compared the aggregate market value of the post-split shares on the day following the split with the market value of the original share on the

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[6]Barker, "Effective Stock Splits," pp. 101-106.
Barker, "Stock Splits in a Bull Market," pp. 72-79.
Barker, "Evaluation of Stock Dividends," pp. 99-113.
Bellemore and Blutcher, "A Study of Stock Splits in the Post War Years," pp. 19-26.
Dolley, "Characteristics and Procedures of Common Stock Split-ups," pp. 316-26.
Fama, *et al.*, "The Adjustment of Stock Prices to New Information," pp. 1-21.
Johnson, "Stock Splits and Price Changes," pp. 675-86.
Kimball and Papera, "Effect of Stock Splits on Short-Term Market Prices," pp. 75-80
Seymour Siegel, "Stock Dividends," *Harvard Business Review*, II (October, 1932), pp. 76-87.
Sussman, *The Stock Dividend*.

[7]Dolley, "Characteristics and Procedures of Common Stock Split-ups," pp. 316-26.

day preceding the split. In 26 of the 95 cases studied, the split resulted in a negative price change; in 12 cases there was no price change; and in 57 cases the change was positive. Dolley concluded that a positive change could be expected from a split about twice as often as a negative price change.

Meyers and Barkay Study

Meyers and Barkay examined the price behavior of seventy split securities during the two-year period 1945-46.[8] Unlike Dolley, the authors believed it desirable to begin the price examination in advance of the split date. Accordingly, price action was measured eight weeks before the authorization of a split and eight weeks after the split. Because the time period involved was relatively lengthy, the authors decided that any general market trend should be eliminated. This approach was accomplished by dividing base date, split date, and post-split date prices by the Standard and Poor's Sub-Industry Common Stock Price Index for the same dates.

Of the 70 stocks examined, 63 demonstrated price increases between the base date and split date. However, some price decline was observed during the post-split period. This behavior was indicated by the fact that only 55 stocks showed price movement more favorable than their industry from

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[8]H. Meyers and Archie Barkay, "Influence of Stock Splits on Market Price," Harvard Business Review, 26 (March, 1948), 251-55.

the base date to the terminal study date.

Meyers and Barkay concluded that price behavior associated with stocks that split could not be fully realized by studying a single day's movement. The authors also concluded that a strong upward tendency is manifest during the weeks prior to the split and that a moderate price decline will be seen in the following eight weeks. They attributed this price decline to over-bullish initial action.

Recent Studies

Barker Studies

Probably the most often cited of the more recent studies are those by Austin Barker.[9] Barker has contributed three separate studies, two of which are concerned with stock splits and one with stock dividends. One analysis involved ninety stocks that split two-for-one and three-for-one during the years 1951-53. After adjusting for industry trends and the increased number of shares of stock, price changes were computed from twelve months preceding the split date to the split date, and from twelve months preceding the split date to six months after the split date. The stocks were classified into two groups according to their recent cash dividend payment. One group consisted of those stocks having recently increased the

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[9]Barker, "Effective Stock Splits," pp. 101-06.
Barker, "Stock Splits in a Bull Market," pp. 72-79.
Barker, "Evaluation of Stock Dividends," pp. 99-113.

cash payout, while the other group contained those not having increased the cash payout. The group that had increased its cash dividend registered an average gain of 15 per cent at the split date. This gain still existed six months later. The group that did not increase the cash payout, registered a 6 per cent gain at the split date; however, no gain was registered six months later. Barker concluded that the initial gain displayed at the split date tends to be only temporary if the stock distribution is not accompanied by an increase of the cash dividend and that the split itself has no lasting effect.

Because the 1951-1953 period represented a "sidewise" market period, Barker later studied 88 stocks that split during the twelve-month period 1954-1955. The data for this bull market period supported the earlier study. The group that had a cash dividend increase recorded an 8 per cent gain over the eighteen-month period, while those not increasing the cash payout recorded an average loss of 12 per cent.

From these studies, Barker concluded that the cash dividend and not the stock distribution was responsible for the stock price changes.

Evaluation

Noteworthy at this point is that Barker attempted to account for only two variables in explaining common stock price changes, i.e., specific industry trends and the direction of cash dividend changes. Other variables generally considered important in the determination of common stock price changes, such as earnings and general market performance, were not mentioned in the studies. Further analysis of these same stocks showed that when they are grouped according to earnings, the earnings increases group out-performed the earnings decreased group.[10] Consequently, one cannot distinguish between the effects of changes in cash dividends and changes in earnings on the market price of splitting stocks.

Johnson Study

Keith Johnson's study "represents an improvement of previously used methodologies in that it attempts to account for the influence of earnings."[11] Johnson compared the mean market price change of 74 large stock splits effected in 1959 by companies listed by the New York Stock Exchange with the mean price change of 74 randomly selected stocks that did not split.

A single thirteen-month price change from eight months before to five months after the split month was calculated for each of the stocks. Analysis of covariance, which is a combination of the regression method and analysis of variance, was employed to compare the prices of stocks that split with those that did not split. The regression equation of price

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[10]J. R. Nelson, "Price Effects in Rights Offerings," Journal of Finance, XX (December, 1965), 425-33.

[11]Johnson, "Stock Splits and Price Changes," pp. 675-86.

changes on changes in earnings, dividends and industry trends was used to remove the effects of these variables on price. The residuals of the regression equation represent price changes after adjusting for earnings, dividends, and industry trends. The adjusted price changes, i.e., residuals for the group of splitting stocks, was compared to the adjusted price changes of the non-splitting group by means of the standard F statistic. Johnson concluded that the adjusted price changes of the split stocks are different from those that do not split after controlling for earnings, dividends, and industry trends. Johnson implied that the difference in mean adjusted price changes between the groups was associated with the presence or absence of splitting.

The conclusion that price action, not explained by these variables, is present in stocks that split, is in direct contrast to the Barker conclusion. In the Johnson study, the variable considered by Barker to explain the price action, i.e., "dividends," was statistically controlled and the price changes were still different. Consequently, cash dividends did not explain price changes. Johnson's conclusion is that the splitting caused some of the price change.

Evaluation

Although Johnson's methodology represents an improvement over that of Barker, it still did not reckon with the trends in general stock prices. In addition, the sample was drawn from a single year representing generally a bull market.

Some recent conclusions concerning the distribution of stock price changes could have very important ramifications for the methodology employed.[12] Specifically, these studies show that the variance of price changes varies directly with the price level of common stocks. This condition represents a violation of the least-squares assumption of constant variance of the residual term. Expressing the variables in the form of natural logarithms helps dampen this effect.[13]

Additional conclusions drawn by several scholars in recent related literature indicate that price changes and also residuals from similar stock price regression equations are not normally distributed.[14] They are said to belong to the more general family of stable Paretian distributions, of which the normal distribution is only a single case. All other cases are characterized by infinite variance. Consequently, the use of least-squares estimates and the F statistic may be inappropriate since both rely on measures of variance.[15] In Chapter III, the point is made that least-squares estimates

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[12] Arnold Moore, "A Statistical Analysis of Common Stock Prices" (unpublished Ph.D. dissertation, University of Chicago, 1962).

[13] Eugene Fama, "The Behavior of Stock Market Prices," Journal of Business, XXXVIII (January, 1965), 34-105.

[14] Ibid.
Benoit Mandlebrot, "The Variation of Certain Speculative Prices," Journal of Business, XXXVI (October, 1963), 394-419.
Eugene Fama, et al., "The Adjustment of Stock Prices to New Information," International Economic Review, X (February, 1969), 1-21.

[15] Fama, "The Behavior of Stock Market Prices," 95.

can be salvaged; however, use of the F statistic may very well be inappropriate because of the infinite variance possibility. In light of these recent results concerning stock price distributions, Johnson's methodology may be suspect.

Fama, et al. Study

The most recent study of the market price changes of common stocks that have split or paid large stock dividends offers improvements on the methodology employed by Johnson. Fama, et al.,[16] studied the monthly returns of 940 New York Stock Exchange stocks that split or paid stock dividends of 25 per cent or greater from January, 1927, through December, 1959. The monthly returns relatives of these stocks were adjusted for general market conditions by regressing the natural logarithms of monthly returns for each stock on the natural logarithms of Fisher's Combination Investment Performance Index. This index, unlike stock price indexes, presents a measure of price changes plus dividend changes.

The data examined in the study are the 61 monthly residual terms from regression equations for each of 940 splits beginning thirty months prior to the split and ending thirty months after the split. The residual terms represent the return relatives adjusted for general market conditions.

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[16] Fama, et al., "The Adjustment of Stock Prices to New Information," pp. 1-21.

By grouping the residuals on a monthly basis, Fama, et al., observed that the average and cumulative average residual terms increased during the period from approximately twenty months before the split to the split month, including a dramatic increase in the last four months preceding the split. This finding means that changes in the general market conditions index underestimated the price changes of these stocks as the split date was approached. The implication is that this change in the relationship between general market conditions and the price of splitting stocks is related to the impending split. During the period following the split month, the residuals are low and the number of positive and negative values are approximately equal. This finding indicates that, during this latter period, the regression function provides a better explanation of price; it also shows that the estimates are just as likely to be high as low.

The data were then classified according to cash dividend behavior into either "increased" or "decreased" groups. Specifically, the total dividends paid per split share during the year following the split were divided by the total dividends paid per equivalent unsplit share during the year preceding the split. This ratio was then related to a similar ratio computed for all the stocks listed on the New York Stock Exchange. If the ratio for the split stock was greater than that of the New York Stock Exchange, it was classified as "increased". If the split stock ratio was the smaller of the two, the stock was classified as "decreased". None of the stocks were "unchanged".

The residual terms were positive for all thirty months preceding the split for both groups. However, the data were significantly different during the period following the split.

For the cash dividend "increased" group, the average residuals remained positive for seven consecutive months following the split. These positive residuals show that no major downward adjustment in the price of the stock occurred following the split.

For the cash dividend "decreased" group, the average residuals in each of the first twelve months following the split were negative. This finding indicates that some expectation had not been realized or that the probability of some event had been drastically changed.

Because 71 per cent of the firms in the study had increased the cash payout, the authors concluded that the reason for the price increase up to the split date was the expected increase in cash dividends. If the dividends had been increased in the following year, the market had correctly anticipated the dividend change and, consequently, no major readjustment of the price was necessary during the post-split period. On the other hand, for the stocks in the "decreased" group the anticipated increase in cash payout was incorrect and therefore did not justify the increases in price during the pre-split period. With each passing month during the post-split period, the market then reduced the probability of a cash dividend increase and consequently readjusted the price. The conclusion was that the price behavior of the split and dividend stocks reflects the information concerning the probability of a favorable change in dividends.

Evaluation

The Fama, et al., model, while reckoning with general market conditions and cash dividends, still explained only 39 per cent of the variations in price. The inclusion in the model of other variables considered important in common stock price determination could have resulted in greater precision by holding constant that portion of the price variation attributable to the additionally included variables. Moreover, the study did not discuss certain other factors, such as the nature of the distribution, i.e., "dividend," or "split," and the size of the distribution. As mentioned previously, both of these variables may affect common stock prices. Finally, the Fama, et al., study made no attempt to consider the effect of the phase of the market in which the distribution occurred, i.e., bull, bear, or no-change.

CHAPTER III

MODEL AND METHODOLOGY

This paper reports a study of monthly price changes of stock split and stock dividend securities. In particular, an investigation is made of the effect of different market periods, the size of the distribution and the nature of the terminology used to describe the distribution on these price changes. This chapter presents the model to be used to study the problem.

Important Variables

To evaluate the role of any one of the above-mentioned factors, control of other concomitant independent variables in some manner is necessary. The literature is well documented with the widely accepted view that the price of a stock is determined by many variables, some of which are earnings, dividends, general market conditions, industry trends, capital structure, interest rates, stock distributions, management, risk, growth, etc. If the price of a stock depends on these variables, the following expression for a security price would seem appropriate:

$$P_{jt} = f(G_t, I_{jt}, C_{jt}, i_{jt}, S_{jt}, M_{jt}, R_{jt}, D_{jt}, E_{jt}, g_{jt}) \quad 3.1$$

where:

P_{jt} = the price of the stock for the j^{th} firm at time t.

G_t = some general stock market indicator at time t. An example is the New York Stock Exchange Common Stock Price Index.

I_{jt} = some specific industry stock price indicator associated with the j^{th} firm at time t. An example is Standard and Poor's Sub-Industry Price Index.

C_{jt} = a capital structure indicator for the j^{th} firm at time t. An indicator would be the debt to total assets ratio.

i_{jt} = the interest rate for acquisition of funds appropriate for firm j at time t.

S_{jt} = stock dividends, stock splits, rights offerings, conversions, options outstanding and new issues for the j^{th} firm at time t.

M_{jt} = some indicator for evaluating management for the j^{th} firm at time t.

R_{jt} = some measures of risk, both business and financial, for the j^{th} firm at time t.

D_{jt} = dividends for j firm at time t.

E_{jt} = earnings per share for the j^{th} firm at time t.

g_{jt} = expected growth in the price of the j^{th} security at time t.

Absolute levels of price are not the primary concern of the investor. Obviously, changes in prices are the substance of profits. Changes in the variables of Equation 1 yield changes in price, or,

$$\Delta P_{jt} = f(\Delta G_t, \Delta I_{jt}, \Delta C_{jt}, \Delta i_{jt}, \Delta S_{jt}, \Delta M_{jt}, \Delta R_{jt}, \Delta D_{jt}, \Delta E_{jt}, \Delta g_{jt}), \qquad 3.2$$

where Δ refers to changes in each of the respective variables.

The above equations attempt to explain stock price changes solely on the basis of concurrent changes in other key variables. However, other time periods, for example, t-1, t-2, etc., and t+1, t+2, etc., may also be appropriate for determining price, in the sense of both lagged and expected data. In regard to lagged data, Friend and Puckett have found, using expressions similar to those above, that lagged data did not significantly improve their model.[17] In regard to expected data, Whitbeck and Kisor[18] and Malkiel and Cragg[19], have found that the explanatory ability of their models was significantly improved by utilizing expectational values supplied by professional security analysts. However, although expected data appears to have improved the regressions of previous studies, such data is not used in this study.

The use of expected data would require ex ante the selection and study of the new distribution securities. It is extremely difficult, if not impossible, to determine those stocks that will effect new distributions in the future. Therefore, the collection of objective expected data on new distribution stocks would require continuous study of an enormous sample of stocks based on the presumption that some of these securities will process splits or stock dividends. Moreover, a major segment of this study is concerned with

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[17] Irwin Friend and Marshall Puckett, "Dividends and Stock Prices," American Economic Review, LIV (September, 1964), 672.

[18] Volkert S. Whitbeck and Manown Kisor, Jr., "A New Tool in Investment Decision Making," Financial Analyst Journal, Vol. 19, No. 3 (May-June, 1963), pp. 55-62.

[19] Burton Malkiel and John Cragg, "Expectation and the Structure of Share Prices," American Economic Review, Vol, LX, No. 4, (September, 1970), pp. 601-17.

the type of market in which the new distribution occurred. Thus, it would be necessary to maintain data files through future bull, bear and no-change market periods. Such a feat would require a very lengthy observation horizon, and thus is rather impractical on an ex ante basis.

No model has been created to date that has the ability to explain all the variation in stock prices. By utilizing a model consisting of a single independent variable, namely, average stock market prices, Fama, et al., were successful in explaining about 39 per cent (R^2 = .39) of the stock price variation.[20] Studies by Friend and Puckett, and Malkiel and Cragg, utilizing models consisting of various forms of dividends and earnings data, produced R^2's of .81 and .83, respectively.[21] A controversey presently exists in financial literature concerning the relative importance of dividends and earnings for the determination of stock prices. This controversey is discussed in greater detail in a later section.

The above variables can be grouped into two general classes, according to whether one or more than one firm is affected by the variable. Those variables which are related to only one firm, such as dividends and capital structure for the j^{th} firm, can be classified as "firm factors." The general

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[20]Eugene Fama, et al., "The Adjustment of Prices to New Information."

[21]Friend and Puckett, "Dividends and Stock Prices," p. 672.

Malkiel and Cragg, "Expectation and the Structure of Share Prices," p. 610.

market variable and specific industry variable can be classified as "market factors," because they are of a more general nature. Therefore, the above equation can be reduced to:

$$\Delta P_{jt} = f(\Delta ff_{jt}, \Delta Mf_t) \qquad 3.3$$

where: Δff_{jt} refers to changes in factors peculiar to the jth firm at time t.

and: ΔMf_t refers to changes in general market activity at time t.

Firm Factors

Financial literature suggests that a stock's price is fundamentally determined by the future benefits expected to be derived from owning that share. Debate continues as to whether these benefits are best approximated by earnings or by cash dividends.

One group of authors asserts that stock values are a function of corporate earnings independent of dividends.[22] Miller and Modigliani state that the division of the earnings

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[22] David Durand, "Cost of Debt and Equity Funds in Business: Trends and Problems of Measurement," Conference on Research in Business Finance (New York, 1952).

Ezra Solomon, "Measuring a Company's Cost of Capital," Journal of Business, XXVIII (October, 1955), 273-79.

Harry Roberts, "Current Problems in the Economics of Capital Budgeting," Journal of Business, XXX (January, 1957).

J. Fred Weston, "The Management of Corporate Capital: A Review Article," Journal of Business, XXXIV (April, 1961).

Franco Modigliani and Merton Miller, "The Cost of Capital, Corporation Finance and the Theory of Investment," American Economic Review, XLVIII (June, 1958), 261-96.

stream between dividends and retained earnings is a "mere detail."[23]

Another group of authors[24] including Walter, Gordon, Gordon and Shapiro, and Bierman-Fouraker-Jaedicke, support the assumption that valuation of shares should equal the present value of expected dividend streams. In describing this school of thought, Lintner re-phrases the famous Miller and Modigliani statement and states that ". . . given the dividend stream, the earnings stream that happens to be associated with it is a mere detail."[25] Lintner further summarizes the distinction between the dividends versus earnings groups as follows:

> (1) Those in the 'pure earnings' group assert that unlevered stock values depend on earnings independent of dividends.
> (2) Those in the 'dividend group' assert that unlevered stock values are, *ceteris paribus*, a function of dividends. In particular, the significance of the time vector of earnings (an investment within the firm) lies in its implications for the prospective stream of

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[23]Modigliani and Miller, "The Cost of Capital, Corporation Finance and the Theory of Investments," p. 272.

[24]James F. Walter, "Dividend Policies and Common Stock Prices," *Journal of Finance*, XI (March, 1956), 29-41.
Myron Gordon, "Dividends, Earnings, and Stock Prices," *The Review of Economics and Statistics*, XLI (May, 1959), 99-105.
Myron Gordon and Eli Shapiro, "Capital Equipment Analysis: The Required Rate of Profit," *Management Science*, III (October, 1956), 102-10.
Harold Bierman, *et al.*, *Quantitative Analysis for Business Decisions* (Homewood, Illinois: Richard D. Irwin, 1965), p. 366.

[25]John Lintner, "Dividends, Earnings, Leverage, Stock Prices and the Supply of Capital to Corporations," *The Review of Economics and Statistics*, XXXXIV (August, 1962), 243-69.

> dividends. Dividends and payout ratios do make a difference that matters in equity values, and hence, in the cost of capital, even when earnings streams are prespecified and fixed in advance.[26]

Since controversy still attends the question of earnings versus dividends in explaining stock prices, for purposes of this study both variables will be employed as predictors in the "firm factors" group in order to derive as powerful a model as possible of stock prices. Some scholars are concerned that the inclusion of both these variables in the statistical model might violate the assumption of independence between explanatory variables. This problem is discussed in a later section.

<u>Market Factors</u>

The study described here will employ a form of the "market model," originally suggested by Markowitz[27] and developed by Sharpe.[28] Although Cohen and Pogue[29] concluded that single-index models performed as well as multi-index

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[26]Lintner, "Dividends, Earnings, Leverage, Stock Prices and the Supply of Capital to Corporations," p. 245.

[27]Harry Markowitz, <u>Portfolio Selection, Efficient Diversification of Investments</u> (New York: John Wiley and Sons, Inc., 1959).

[28]William F. Sharpe, "A Simplified Model for Portfolio Analysis," <u>Management Science</u>, (January, 1963), 277-93.

[29]Kalman J. Cohen and Jerry A. Pogue, "An Empirical Evaluation of Alternative Portfolio-Selection Models," <u>Journal of Business</u>, XXXX (April, 1967), 166-93.

models, other authors, notably King[30] and Wallingford,[31] have concluded that security price changes can be broken down into market, industry, and individual security components. These latter studies support the hypothesis that multi-index models outperform single-index models; therefore, both market and industry indexes are utilized in this study.

Estimates of the average market price of stocks are made by investor services such as Dow Jones, Standard and Poor's and also the New York Stock Exchange. Another index of general returns of common stocks, which includes measures of both dividends and price changes, is Fisher's Combination Investment Performance Index. Any of these indexes could be used to represent the "total market" factors within the model.

Industry peculiarities may also contribute to price movements. For example, general stock prices may be increasing, but due to peculiarities in, say, the steel industry at that time, steel stock prices may be declining, or vice versa. Hence, it is felt that, in addition to the general market index, some account should be taken of industry conditions. Standard and Poor's offers an index of stock prices for 100 sub-industry classifications, and these data provide a means of reckoning with industry trends.

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[30]Benjamin F. King, "Market and Industry Factors in Stock Price Behavior," Journal of Business, XXXIX (January, 1966), 139-90.

[31]Buckner Wallingford, "A Survey and Comparison of Portfolio Selection models," Journal of Financial and Quantitative Analysis, II (June, 1967), 85-104.

The fact that the averages for all stock prices, or those of a specific industry, move in some direction does not necessarily imply that each stock's price will move in the same direction and by the same amount. Factors peculiar to the firm (for example, dividends and earnings) may be the cause for this difference. Thus, these variables have also been included within the model, as indicated earlier.

When the above-mentioned variables are substituted for the firm and market factors of equation 3.3, the change in price of the j^{th} stock at any point in time is given by:

$$\Delta P_{jt} = f(\Delta D_{jt}, \Delta E_{jt}, \Delta I_{jt}, \Delta M_{jt}) + u_{jt} \qquad 3.4$$

where:

ΔP_{jt} = change in the price per share of j^{th} stock at time t.

ΔD_{jt} = change in the dividend per share of the j^{th} stock at time t.

ΔE_{jt} = change in the earnings per share of the j^{th} stock at time t.

ΔI_{jt} = change in the specific industry index associated with the j^{th} firm at time t.

ΔM_{jt} = change in the General Market index at time t.

u_{jt} = all the relevant variables not specifically included in the model.

Previous models of stock price estimation, i.e. those of Gordon, Friend and Puckett, and Lerner and Carlton, deal primarily with firm factors, such as dividends, earnings, prior price changes, and capital structures.[32] These models neglect the influence of industry trends and general stock market behavior. The model presented by Fama, et al.,[33] discussed in Chapter II, neglects earnings and specific industry trends. The model used in this study attempts to combine the best part of both approaches. Therefore, the model includes firm factors, specific industry factors and general market factors. This line of reasoning is generally in accord with King's hypothesis that stock prices are determined by market, industry, and firm factors.[34]

Although it is not possible to include in any stock valuation model all factors that influence security prices, Chapter IV shows that the variables which are included in this study have considerable explanatory power.

As previously stated, the objective of this study is to determine whether the price changes of stock-dividend and split securities are different from those stocks not associated with new distributions. In addition, the research seeks

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[32] Myron Gordon, The Investment, Financing, and Valuation of the Corporation (Homewood, Illinois: Richard D. Irwin, Inc., 1962).

Friend and Puckett, "Dividends and Stock Prices," pp. 656-82.

Eugene Lerner and Willard Carlton, A Theory of Financial Analysis (New York: Harcourt, Brace and World, Inc., 1966).

[33] Fama, et al., "The Adjustment of Stock Prices to New Information," pp. 1-21.

[34] King, "Market and Industry Factors in Stock Price Behavior," p. 140.

to determine the relationship that price changes of stock dividend and split securities have to (1) the size of the distribution, (2) the nature of the terminology used to describe the distribution, and (3) the market character for the period in which the distribution occurred. In order to isolate the effect of these particular variables on price, holding constant in some manner those concomitant variables considered above to be influential in determining price is necessary. This approach will be achieved by treating the conceptual model discussed in the above as an empirical equation. The empirical model used in this study will now be described.

Regression Model

The firm and market factors will be held constant statistically with a linear multiple regression model. The model in its conceptual form will appear as:

$$\ln \frac{P_{jt}}{P_{jt-1}} = B_1 + B_2 \ln \frac{D_{jt}}{D_{jt-1}} + B_3 \ln \frac{E_{jt}}{E_{jt-1}} + B_4 \ln \frac{I_{jt}}{I_{jt-1}} + B_5 \ln \frac{M_t}{M_{t-1}} + u_{jt} \qquad 3.5$$

This model regresses the one-month changes in natural logarithms of price of the j^{th} firm on the changes in natural logarithms of dividends, earnings, specific industry stock prices and general stock market prices for the same time periods.

The changes in the variables are expressed in logarithmic form rather than as simple changes for several reasons. First the natural logarithms of relatives are the first differences of the natural logarithms of the variables, i.e., $\ln P_t/P_{t-1} = \ln P_t - \ln P_{t-1}$; hence, using logarithms implies consideration of changes. It has been shown that the variability of absolute price changes for a given stock increases as the price level of the stock is increased; employing changes in the natural logarithms of prices tends to neutralize this effect.[35] Second, changes in the natural logarithms of prices represents the yield with continuous compounding for the time interval being examined.[36] Third, use of chnages in natural logarithms of prices often removes secular trends.[37]

The regression model, as presented above will be used to hold constant the independent variables included in the equation. When the coefficients for the equation are statistically estimated, an estimate for the price relative of the security can be made. The estimate of the price relative given by the statistical equation represents the best approximation, linear in the parameters, of the observed price relative that can be made based on the particular set of independent variables included in the model.

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[35]Fama, "The Behavior of Stock Market Prices," p. 45.

[36]Fama, "The Behavior of Stock Market Prices," p. 45.

[37]Bruce Fielitz, "Stationarity of Random Data: Some Implications for the Distribution of Stock Price Changes," (Accepted for publication by the Journal of Financial and Quantitative Analysis).

An adjusted price relative, i.e., the residual u_{jt} term, can be estimated by subtracting the price relative which is estimated by the variables in the model, from the observed price relative as follows:

$$\ln \frac{P_{jt}}{P_{jt-1}} - [\, B_1 + B_2 \ln \frac{D_t}{D_{t-1}} + B_3 \ln \frac{E_{jt}}{E_{jt-1}} + B_4 \ln \frac{I_{jt}}{I_{jt-1}} + B_5 \ln \frac{M_t}{M_{t-1}} \,] = u_{jt} \qquad 3.6$$

The term in brackets on the left side of equation 3.6 represents the explanation of changes in the dependent variable, while u_{jt} represents error, which is due partly to the explanatory power of the variables not specifically included in the model. This residual term represents price changes, after having been adjusted for earnings, dividends, industry stock price trends, and general stock market changes.

Application of the Least-Squares Method

The requirements for appropriate use of the least-squares method are that the residuals have zero expectation, have constant variance, be serially independent, and be distributed independently of the independent variables. In addition, the assumption of normality of the residuals is desirable if standard tests of significance are to be utilized.

<u>Zero Expectation</u>

One assumption of the least-squares estimation procedure is that the expected value of the residuals is zero. Draper and Smith provide a means of examining residuals for this characteristic.[38] The method consists of plotting the residuals and observing the distribution about the zero value. These distributions are then compared to distributions selected from a table of random numbers. When residuals in the current study were subjected to this examination process, the plots exhibited only slight irregularity when compared to distributions of random plots. Thus the results show that the assumption of zero expectation of the residuals is justified.

Fama, <u>et al</u>., utilizing a method similar to that employed in this paper, suspected that during the months near the new distribution date, the behavior of security prices would be significantly influenced by factors associated with the new distribution. Because a specific variable was not included in the model to account for price changes attributable to the new distribution, Fama, <u>et al</u>., felt the model would be subject to specification error in the months surrounding the new distribution date. Thus, the expected value of the residual would not be zero. To eliminate this potential source of bias, they excluded observations near the new

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[38] N. R. Draper and H. Smith, <u>Applied Regression Analysis</u>, (New York: John Wiley and Sons, 1966), p. 86.

distribution month from parameter estimation procedures. At the same time, the same parameters were estimated before excluding any data. Fama, et al.,[39] found that estimates from the two sets of data were not greatly different. Thus, specification error of the type mentioned above did not appear to present a problem and the conclusions of the study were not affected.

In light of these Fama, et al., results, and the actual tests of the regression residuals employed in this paper, the assumption of a zero expected value for the residuals is considered plausible.

Constant Variance

The appropriate use of least-squares requires that the residual terms be independently distributed random variables with constant variance from one observation to another. Draper and Smith suggest that time-sequence plots of the residuals provide a method by which this assumption of constant variance can be examined.[40] Time-sequence plots of the residuals considered in this study indicate that the assumption of constant variance is fulfilled. The time-sequence plots for the majority of stocks in the study depicted a horizontal band, an indication that the variance of the residuals is relatively constant.

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[39]Fama, et al., "The Adjustment of Stock Prices to New Information," p. 6.

[40]Draper and Smith, Applied Regression Analysis, p. 86.

Serial Independence of Residuals

The assumption of independence of residuals requires that the residual at any point in time cannot be dependent on, nor correlated with, the residual at some other point in time. The horizontal bands depicted by the time-sequence plots discussed above show that serial dependence is not a major problem. Moreover, in the Fama, et al. study, the average value of the first-order serial-correlation coefficients was -.10.[41] This value shows that serial correlation was not a serious problem in their study. Since the method of this study is similar to Fama, et al., and since the plots of residuals do not pose a serial correlation problem, the assumption of serial independence of the residuals seems appropriate.

Thus, in general, the graphs of the residual data indicate that the assumptions of zero expectation, constant variance and serial independence have been satisfactorily met. In this sense, the conclusions in this paper are in agreement with the Fama, et al.,[42] study which concluded that its residual data also conformed well to the least-squares assumptions.

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[41]Fama, et al., "The Adjustment of Stock Prices to New Information," p. 6.

[42]Fama, et al., "The Adjustment of Stock Prices to New Information," pp. 1-21.

Least-Squares

The regression model explained above derives estimates for the equation parameters by minimizing the sum of the squared difference between the regression function and the observations. The asymptotic properties of the parameters in least-squares regression analysis are closely dependent upon the assumption of finite variance in the distribution of residuals. Thus, least-squares estimates may be unappealing if the variance of the residuals is not finite.

Recent studies concerning the distribution of the natural logarithms of stock price relatives have concluded that these changes are non-Gaussian members of the stable Paretian family of distributions.[43] Moreover, evidence by Fama, et al.,[44] has indicated that residual terms very similar to those studied in this paper may also be non-Gaussian stable Paretian. These results are important to this study mainly because of the infinite variance characteristic associated with non-normal stable Paretian distributions. As previously mentioned, least-squares estimates are dependent on finite variance.

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[43]Benoit Mandelbrot, "The Variation of Certain Speculative Prices," Journal of Business, XXXVI (October, 1963), 394-419.

Fama, et al., "The Behavior of Stock-Market Prices," pp. 34-105.

[44]Fama, et al., "The Adjustment of Stock Prices to New Information," pp. 1-21.

Practically speaking, infinite variance does not mean that the computed dispersion values for the u_{jt} terms will be infinite. Rather, infinite variance means that the sample standard deviation and variance of non-Gaussian members of the stable Paretian family of distributions will display extremely erratic sampling behavior, regardless of the sample size. This situation may lead to erratic or widely-varying regression parameter estimates, and thus least-squares estimation procedure may be inappropriate.

Wise[45] has derived necessary and sufficient conditions for linear least-squares estimators for linear regression systems having infinite residual variances. He has shown (1) that least-squares estimates can be made, and (2) that these estimates are consistent and unbiased. However, he has also shown that least-squares estimators are not "best"; that is, they are not the most efficient estimators.[46] Thus the possibility exists that the sampling variance of the least-squares estimators may be larger than the estimators obtained by some other estimation procedure. For this reason, the specific explanatory variables may not be extremely accurate predictors of stock prices.

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[45] John Wise, "Linear Estimators for Linear Regression Systems Having Infinite Residual Variances," paper presented at the Berkley-Stanford Mathematical Economics Seminar (October, 1963).

[46] It has been suggested that absolute value regression estimators may be more efficient than least-squares estimators. See Eugene Fama, "The Behavior of Stock-Market Prices," p. 95.

From a practical viewpoint, most estimation procedures result in a trade-off between desirable and undesirable properties. For example, estimation procedures that result in unbiased estimators are useful, but sometimes considerations other than bias are more important. For instance, the maximum likelihood in general provides estimators that are biased. However, these estimators are at the same time, consistent, sufficient, most efficient, etc.[47] Consequently, the maximum likelihood method of estimation is extremely useful even though bias may result.

In this study, an examination of the dispersion surrounding the regression parameter estimates suggest relatively small variance. Consequently, the use of other more efficient procedures probably would not greatly improve the empirical validity of the model.

Normality of Residuals

As referred to in the above discussion, the assumption of a normal distribution for the regression residuals is desirable if standard statistical tests - for example, t and F-tests - are to be used to compare the monthly residual values under the different hypotheses to be tested in this paper. Normality of the u_{jt} values is not necessary if one wishes only to estimate the parameters of the regression

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[47] E. S. Keeping, Introduction to Statistical Inference, (Princeton, New Jersey: D. Van Nostrand Company, Inc., 1962), p. 125.

function. In fact, the immediately preceding paragraphs summarizing Wise's results have shown that it is possible to estimate least-squares regression parameters even under a condition of infinite variance of the residual term. However, in order to employ standard t and F-test methods for comparison of residual terms, the u_{jt} values should be normally distributed. As indicated earlier, non-Gaussian members of the stable Paretian family of distributions are characterized by infinite population variance, and by erratic sampling variances. Thus, in testing for differences between and among monthly regression residuals under the various hypotheses enumerated earlier, use of standard methods, such as t and F-test, which require normality and therefore finite second moments, may be inappropriate. Consequently, the monthly residuals are tested for normality in a later section.

Stepwise Regression Model

The most commonly used method of least-squares regression estimation simply regresses a dependent variable on a fixed set of independent variables. These independent variables are assumed to have explanatory ability. Other regression procedures are available which attempt to estimate the "best" regression equation, i.e., one which includes only variables that explain a significant portion of the variation in the dependent variable, and in which the independent variables selected represent that combination that explains the greatest amount of dependent variable variation.

In an attempt to find the "best" regression equation, the stepwise regression method has been selected for use in this study. Two reasons provide justifications for the stepwise procedure. First, because of the lack of agreement associated with the theoretical stock valuation model resulting from the earnings-versus-dividends controversy referred to in the above discussion of firm factors, a statistical method is needed that will permit an empirical decision to be made regarding the importance of dividends-versus-earnings for the particular data used. Second, one might suspect that the market index factor will not be strictly independent of the industry factor, nor will dividends be strictly independent of earnings. Use of the stepwise procedure provides an advantage over the traditional regression model by limiting the inclusion of extremely collinear independent variables. The method by which the stepwise procedure accomplishes this result will now be described.[48] First, the simple correlation matrix is computed, and the independent variable having the highest correlation with $\ln \frac{P_t}{P_{t-1}}$ is selected and entered as the first independent variable in the equation. $\ln \frac{P_t}{P_{t-1}}$ is then regressed on this selected independent variable (X_1). An F statistic is computed to determine if a significant portion of the variance has been explained. If X_1's explanation is

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[48]This discussion closely parallels that of Draper and Smith. See Applied Regression Analysis, p. 171.

significant at some percentage level, the partial correlation coefficients are computed for the remaining independent variables not included in the model. Hence, if there are four independent variables, i.e., X_1, X_2, X_3, X_4, and dependent variable, X_5, the partial correlation coefficients $r_{52.1}$, $r_{53.1}$, and $r_{54.1}$ are calculated. The coefficient $r_{52.1}$ represents the partial correlation of independent variable X_2 on the dependent variable X_5 after X_1 has been included in the model. The variable having the greatest partial correlation coefficient is selected to determine if it should be entered. The multiple correlation of this independent variable with the other independent variables is computed to determine if high collinearity is present. If this problem exists, the independent variable is not entered into the model. For example, if the coefficient of determination is greater than R=.98, the above variable is eliminated so that matrix computations can continue. The inclusion of this criterion reduces the possibility of degeneracy when an "independent" variable is approximately a linear combination of other independent variables. Moreover, if the multiple correlation coefficient between a number of so-called independent variables is so large that most of the variability in one independent variable is related to the other independent variables, this variable will not be placed in the regression. If the collinearity test does not exclude the variable from the model, and if its inclusion offers explanatory ability to the model which is significant at, say, the .01 level, it is entered.

Continuing with the above example, assuming $r_{54.1}$ is the largest of the three partial correlations, variable X_4 would be the next variable entered. With the new regression equation $X_5 = f(X_1,X_4)$, the contribution of X_1 is re-examined as if X_4 were entered first and X_1 second. If X_1's contribution is still significant at the specified level, partial correlation coefficients $R_{52.14}$ and $R_{53.14}$ are computed for the remaining independent variables, given that X_1 and X_4 are in the model. The variable associated with the larger partial correlation coefficient is the next variable entered in the model. Based on its explanatory contribution as in the previously discussed case, it is tested to be either accepted or rejected by the model. This process is repeated until all remaining variables do not contribute significantly to the explanation of the variation of the dependent variable. At this point, the computations cease and the regression equation is completed.

As mentioned briefly above, the stepwise regression procedure was employed instead of the traditional regression procedure in this study for two reasons. First, the traditional regression method assumes that the explanatory variables are independent of each other. However, the nature of the explanatory variables in the model as advanced in this study makes them suspect of collinearity. Use of the stepwise procedure serves to limit the degree of collinearity in the model.

Second, no generally accepted valuation theory exists to completely explain stock prices; therefore, the model utilized in this paper includes variables which have been often suggested as being important in determining stock prices. The stepwise procedure selects from these suggested variables only those which best explain stock price changes. Inasmuch as the purpose of the model is to explain in a reasonable way a large portion of the price change, the stepwise approach was favored.

Empirical Tests

By employing the above discussed stepwise procedure, a regression equation and a table of u_{jt} values are calculated for each stock from the sample of new distribution securities. As explained earlier, the u_{jt} values are then obtained by subtracting the estimated value for stock price changes (estimated by the regression equation) from the actual price change for the j^{th} stock at month t. The study is concerned with price changes around the split month; accordingly, all values of the residuals are indexed in terms relative to the split month. For a given stock, we define month $t=0$ as the split month, with month $t = t+1$ the month immediately following the split and month $t = t-1$ the month preceeding the split. The values for u_{jt} represent price changes that would not be predicted by dividends, earnings, market and industry variables. To minimize the effect of extreme price changes associated with any one individual security for each month studied, the behavior of the average u_{jt} values for all j are examined. The average of the u_{jt} values for month t, i.e., $\bar{u}_t$, is computed as follows:

$$\bar{u}_t = \frac{\sum_{j=1}^{n} u_{jt}}{N}$$

where u_{jt} is the sample regression residual for the j^{th} stock at month t and n is the number of stocks studied. The u_t's are computed for each month studied surrounding the split date, i.e., $-5 \leq t \leq +6$.

The cumulative effects of price behavior are also of interest and will be examined for the same twelve month period. Thus, the cumulative average residual is

$$U_t = \sum_{t=-5}^{6} \bar{u}_t$$

where $-5 \leq t \leq +6$, and U_t represents the cumulative values for price behavior not explained by the above cited independent variables.

Because we are interested in determining whether price changes are affected by new distributions, the residuals of a sample of new distribution stocks are compared to those of a sample of stocks that did not process a new distribution. In addition, since we are concerned with the influence of the market period on the prices of new distribution securities, these average and cumulative average regression residuals are also grouped and compared according to the character of the stock market period in which the new distribution occurred, i.e., bull, bear, and no-change. A comparison of the residuals for groupings based on the size of the distribution is also made between groups of (1) less than 50 per cent, (2) between 50 per cent and 99 per cent, (3) 100 per cent, and (4) greater than 100 per cent. Finally, the residuals are grouped according to the nature of the terminology used to describe the new distributions, i.e., "stock dividend" or "stock split".

Testing the Residuals

In order to utilize standard t and F tests for comparisons of the various groups of residuals, the residuals should be normally distributed. As indicated earlier, Fama has presented findings that support the hypothesis that the distribution of residuals values obtained from models which utilize stock price relatives as the independent variable may be members of the non-Gaussian family of stable Paretian distributions.[49] The non-Gaussian stable Paretian distributions are characterized by "infinite" variance. The infinite variance characteristic does not mean that the computed sample value for variance will be "infinity"; however, it means that

[49]Fama, "The Behavior of Stock-Market Prices," 34-105.

the sampling variance from such distributions does not dampen nearly as much with increases in sample size as would be expected in a normal distribution. If the hypothesis that the distribution of price changes is normal cannot be supported, nonparametric tests should be substituted for those based on variance and standard deviation.

The residuals are tested for normality by means of the Kolmogorov-Smirnov test.[50] To employ this test, for a given sample, one determines $D = \max \cdot_{m} [F^*(X) - S_n(X)]$ where $S_n(X)$ is the sample cumulative distribution function and $F^*(X)$ is the cumulative normal distribution function with $u = \bar{X}$ (the sample mean) and $\alpha^2 = S^2$ (the sample variance). If the value of D exceeds the critical value, the hypothesis that the observations are from a normal population is rejected. The sample is being tested to determine if it has a specific cumulative distribution, in this case the normal distribution. For any specified value of X, $F^*(X)$ is that proportion of price changes in the population having values less than or equal to X. The cumulative step function of a random sample is expected to be closely approximated by the cumulative frequency of the normal distribution. If a significant difference is found, the two distributions are considered to be different.

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[50]Hubert Lilliefors, "On the Kolmogorov-Smirnov Test for Normality with Mean and Variance Unknown," Journal of the American Statistical Association, (June, 1967), 404-19.

In addition to the Kolmogorov-Smirnov test, a further test of normality has been suggested by Fama based on a statistic computed by Tippett[51]. One characteristic of non-Gaussian members of the stable Paretian family of distributions is a greater than normal frequency of occurrences in extreme tails. Analysis of the extreme values in the tails of a sample distribution generally should indicate whether or not the sample is drawn from a normal population. The minimum and maximum values may be tested with the Tippett test for extreme values. Tippett has calculated a frequency distribution of maximum and minimum values of samples from a normal population for several values of n.

If the assumption of normal distribution is tenable, F tests can be used to compare the average residuals for the bull, bear, and no-change market periods to determine whether or not the market period is a relevant variable. The same F statistic can also be computed for comparisons based on the size of the distribution. Finally, the student t statistic can be utilized to determine if "stock dividend" distributions differ from "stock split" distributions. If the normality assumption is not accepted, the non-parametric Kruskal-Wallis[52] H test may be substituted for the t and F tests.

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[51]Fama, "The Behavior of Stock-Market Prices," pp. 50-52.

[52]James V. Bradley, Distribution-Free Statistical Tests, (Englewood Cliffs, New Jersey: Prentice-Hall, 1968), p. 125.

The Kruskal-Wallis H statistic is a rank-sum non-parametric statistic used to test the hypothesis that C populations (or treatments from the same population) are identical, against the alternative that they are not, with special sensitivity to difference in location.

After the data are grouped according to C treatments, all observations in the sample are ranked in order of magnitude, and each observation is replaced by its size rank. The values T_i, $i=1 \cdots C$ and $\overline{T}_i = T_i/R_i$ respectively, are defined as the sum and mean of the R_i ranks in the i treatment. The mean of the N ranks will be $(n+1)/2$, and this will be the expected value of the treatment mean T_i, and consequently the mean of the sampling distribution of T_i. The statistic

$$H = \frac{12}{N(N+1)} \sum_{i=1}^{C} R_i \left(\overline{T}_i - \frac{N+1}{2}\right)^2 ,$$

follows a chi-square distribution with C-1 degree of freedom for $n_i \geq 8$. The null hypothesis is rejected if H falls in the upper-tail region at a specified significance level.

For ease of computations the following equation can be used:

$$H = \frac{12}{N(N+1)} \sum_{i=1}^{C} \frac{T_i^2}{R_i} - 3(N+1)$$

This chapter has presented the model to be used in this paper in its conceptual and empirical forms. The specific least-squares procedure to be used to hold statistically constant certain concomitant factors has been discussed as well as the computations of the adjusted data. The methods available to make comparisons along with the necessary normality justification tests have been explained. The model as described in this chapter was applied to a specific set of firms to test certain hypotheses concerning type of market, size of distribution and terminology used to describe the distribution, and the influence of these factors on the market price behavior of new-distribution securities. The next chapter will present a discussion of the empirical results.

CHAPTER IV

SAMPLE AND TEST RESULTS

This chapter presents the results of empirical tests employing the model discussed in Chapter III. Specifically, the discussion in Chapter IV relates to eight topics:

(1) Sample Selection. Explanations of the selection of the sample and the adjustment of the data are presented.

(2) Regression Method: An Example. An example of the regression method utilized to compute the adjusted price relatives, i.e., the regression residuals, is discussed.

(3) Normality Tests. The computed residuals obtained from the regression model for each stock over the total time interval are presented and tested for normality utilizing the Kolmogorov-Smirnov and the Tippett tests.

(4) Effect of Stock Distribution. The regression residuals of the stocks associated with splits and stock-dividend distributions over the total time interval are compared to similarly derived residuals from a sample of stocks not associated with such new distributions.

(5) Effect of Market Periods. The new-distribution stock residuals are grouped according to the specific market period in which the distribution occurred and are compared using the Kruskal-Wallis statistic.

(6) Effect of Terminology. The residuals over the total time interval are divided into "stock dividend" and "split" groups and compared using the Kruskal-Wallis test.

(7) Effect of Distribution Size. (a) The new stock distributions referred to as "splits" are grouped over the total time interval according to the size of the distribution. More specifically, the Kruskal-Wallis statistic is used to compare the following groups: (1) 20-49 per cent, (2) 50-99 per cent, (3) 100 per cent, and (4) greater than 100 per cent.

(b) The new stock distributions referred to as "stock dividends" are grouped over the total time interval according to the same distribution-size classification given in (7a) and are tested by the same procedure discussed for stock splits.

(8) Effect of Size and Terminology. Stock splits are compared over the total time interval to stock dividends of equivalent distribution size by means of the Kruskal-Wallis test. For example, 100 per cent stock dividends are compared to two-for-one stock splits, stock dividends greater than 100 per cent are compared to stock splits greater than two-for-one, etc.

Sample Selection

Market Period Studied

The total time interval studied encompasses a total of three years selected from the calendar period July, 1963, to December, 1968. As discussed in Chapter I, one of the major aims of this study is to examine the effect of different stock market periods on price changes of stocks experiencing stock splits and stock dividends; therefore, the selection of these market periods within the total time interval is important. The intent of the market selection process was that, subject to certain data restrictions which will be explained below, the periods selected be the most recent years in which market trends could be clearly identified.

The basis for selection of the three periods used in this study was the performance of the Dow Jones Average of Industrial Common Stock Prices. In selecting the most recent suitable bull market, the Dow Jones 1964 average was seen to increase continuously from a level of 760 in January to 880 in December. The calendar year 1965 was also clearly a bull-market year. However, it had fewer stock dividends than the 1964 period, and the two-month May-June, 1965, period experienced a steady 75-point decline in the Dow Jones Industrial Average. For these reasons, 1964 was selected to represent a bull-market period.

The selection of a recent bear-market period was made in a similar manner. During 1966, the Dow Jones Industrial Average dropped steadily from 1001 in January to 735 in early October. During most of the last four months of the year, the average remained in a range of 760 to 800, ending the year at about 780. Even though for the last few months the Dow Jones Average was relatively stable, a 22 per cent decline in the average over the twelve-month period was considered significant; therefore, 1966 was selected as the bear-market period.

Mid-1967 to mid-1968 was similarly chosen as the most recent no-change market period. Although prices during this period tended to display a large variance, there was no trend observed. During most of this period the average remained in the 850-to-900 range.

Selection of Stocks

Once the market periods were determined, the individual stock split and stock-dividend companies to be studied were selected from January issues of *Financial World*. Each year this service compiles a list of all the stocks on the New York and American Stock Exchanges that experienced stock splits and stock dividends of 20 or more per cent during the previous year. Fifty securities were selected at random from each of the three market periods. However, several securities were eliminated from each sample because they were involved in mergers, multiple large stock distributions, or were not listed on the exchanges for the complete period studied. These securities were excluded because of possible price action considered uncontrollable with the statistical methodology being employed in this study. In all, 28 firms were discarded from the sample for one reason or another, leaving 39 in the bull period, 41 in the bear period, and 42 in the no-change period.

Length of the Study Period

To compare pre-distribution price informational value with post-distribution price informational value, the data must be examined far enough in advance so that the stocks' price is not subject to influence by knowledge of the impending split. The Fama, *et al.*, study discussed in Chapter II indicated that the median time period between the announcement date and the effective distribution date was 44.5 days. Moreover, in only ten per cent of the cases studied in that paper was this time period greater than four months.[53] The assumption was made in this study, that price changes computed

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[53] Fama, *et al.*, "The Adjustment of Stock Prices to New Information, p. 18.

six months prior to the effective distribution date would in most cases be sufficient to indicate both price performance associated with pre-distribution information as well as post-distribution information. Therefore, monthly data was collected starting six months before the actual distribution month and ending six months after the distribution month.

Adjusting the Data

The purpose of the regression model discussed in Chapter III is to eliminate that part of the price changes that can be explained by changes in the relevant independent variables. Therefore, the input data must necessarily represent these variables properly.

To compare prices before the distribution of new shares with those after the distribution, either the pre-distribution prices must be adjusted to reflect the post-distribution number of shares or vice-versa. The adjustments have equivalent effects on the computed value for the price change. In this study, the pre-distribution prices were chosen for adjustment.

The monthly prices for each security were compiled for each of the thirteen months of the study period. These data were obtained from the New York and American Stock Exchange quotations as they appeared in the appropriate Wall Street Journal on the first day of the month that the stock was traded. Hence, thirteen prices for each security were gathered and adjusted for stock splits and stock dividends. These prices were then expressed in the form of one-month lagged price relatives, or $\frac{P_t}{P_{t-1}}$. Consequently, twelve monthly price relatives are shown for each of the 122 stocks. The relatives represent the dependent variables in the regression model. The twelve relatives were computed by dividing, for example, the adjusted price in the fifth month before the new distribution by the adjusted price from the sixth month before the new distribution, i.e., P_{t-5}/P_{t-6}; the next relative was computed by dividing the price in the fourth month before the new distribution by the price in the fifth month prior to the new distribution, i.e., P_{t-4}/P_{t-5}. This process continues through to the sixth month after the month of the new distribution.

Dividends

As with the case of stock price comparisons to permit valid comparisons of the data over time, cash dividend changes must also be stated in pre-distribution or post-distribution quantities. As mentioned, either the pre-distribution dividends or the post-distribution figures could be adjusted, but for consistency with the adjustment of price data, the pre-distribution cash dividends were chosen for adjustment.

Changes in dividends were of two types, i.e., explicit changes in per-share dividends and implicit changes brought about by continuing the old dollar amount of the dividend for each of the total new shares. In either case, the adjustment was the same, i.e., the pre-distribution dividend was divided by the post-distribution number of shares.

Since the model is concerned with changes in the independent variables, the dividend changes are also stated in relative terms, for reasons similar to those given in the price variable discussion. The dividend relatives were computed for the same dates as were the price relatives. The dividend relative for month t was computed by dividing the adjusted cash dividend figure for that month by the adjusted cash dividend figure for the preceding month, i.e., D_t/D_{t-1}. A cash dividend relative is computed for each of the twelve consecutive months beginning five months before the split. If the cash dividend in month t were \$0.50 and \$0.60 in month t-1, then \$0.50/\$0.60 = 83 per cent; we conclude that the cash dividend declined by 17 per cent.

Four dividend changes of zero to a positive value were recorded. Because such changes could not be defined for purposes of this study, in order to estimate a change value a constant of \$1.00 was added to both values in the relatives. No changes in dividends from a positive value to zero value were encountered in the data.

The dividend figures used are those estimates of yearly dividends presented in the daily stock price quotations of the Wall Street Journal for the same date from which the price data were gathered, i.e., the first day the stock was traded for each month in the study. Because the Wall Street Journal is very widely used, and because price changes are probably responsive to dividend estimates, this source of data would seem to offer more information for determining price than could be obtained from recent actual dividends for the year.

Earnings

As in the case of dividends and prices, monthly earnings changes are expressed in the form of relatives. These data were also adjusted for stock dividends and stock splits. Most of the quarterly earnings figures presented in this study were compiled from Moody's Handbook of Common Stocks, though both Value Line and Standard and Poor's Stock Guides were utilized when the required information was not available in Moody's Handbook. Stock for which the earning data involved both positive and negative values were eliminated from the sample in order to simplify the computation of earnings relatives. Care was taken to be sure that the data had been adjusted for stock distributions in a manner similar to that applied to the previously discussed variables.

General Market Index

Stock prices have been shown to be affected by variables other than those associated directly with the firm factors discussed in Chapter III. Changes in general stock prices are believed to be an indicator of individual firm stock-price changes. Fama, et al., found this to be the case in their study, in which they utilized a single composite independent variable consisting predominately of an average of stock prices.[54] Therefore, Standard and Poor's Daily Index

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[54]Fama, et al., "The Adjustment of Stock Prices to New Information," p. 5.

of 425 Industrial Common Stocks was compiled for the first day of each month in the study period. Since changes in the general market-index variable were required for the model, monthly market index relatives were computed in a manner similar to that of the other variables.

Specific Industry Index

Each firm studied in this paper was assigned to one of the Standard and Poor's sub-industry classifications. The industry weekly common stock price index was recorded for each stock for the first week of the month in the period studied. As with all other variables in the model, the changes were expressed as monthly relatives.

Control Group Stocks

A sample of 122 stocks that did not process stock splits or stock dividends was randomly selected from the same time period as the new-distribution stocks. The securities were selected from Moody's Handbook of Common Stocks for 1964, 1966, 1967 and 1968. Specifically, 41 stocks were selected from the bear-market period, 39 from the bull-market period and 42 from the no-change period. As was the case with the new-distribution stocks, this sample excluded those securities whose prices were considered difficult to control with the methodology being used. Data similar to that compiled for the split and stock-dividend securities was compiled for this control group. These data were then subjected to the same adjustments as the split and stock-dividend data.

Regression Method: An Example

A regression equation, based upon the twelve monthly intervals for which relatives were computed, was calculated for each of the 122 stocks in the split and stock-dividend sample, and for the 122 stocks in the control group. The residuals from the regression equations were then computed for each stock in both groups. As an example of the process employed, consider the case of Michigan Seamless Tube. The natural logarithms of twelve monthly price relatives (variable X_5) surrounding the new distribution date were regressed in a stepwise manner on the natural logarithms of monthly relatives of (1) Standard and Poor's Sub-Industry Stock Price Index for steel stocks (X_1), (2) Standard and Poor's Index of 425 Industrial Stock Prices (X_2), (3) dividends (X_3), and (4) earnings (X_4). The stepwise procedure produced the correlation matrix of Table 4.1. This table shows that the market index variable has the highest correlation (.870) with the dependent variable, and that there is a strong correlation (.798) between the industry index variable and the market index variable. The industry index variable should be noted as being also highly related (.638) to the dependent variable.

The market index variable has the greatest simple correlation with the dependent variable, i.e., price relative; therefore, the stepwise procedure indicates that this variable should be entered into the model first. As a first step

TABLE 4.1

MATRIX OF CORRELATION COEFFICIENTS

VARIABLE	PRICE RELATIVE	INDUSTRY RELATIVE	MARKET RELATIVE	DIVIDEND RELATIVE	EARNINGS RELATIVE
PRRL	1.00000	0.63817	0.87079	-0.21024	-0.37618
INIR	0.63817	1.00000	0.79885	0.38699	-0.26960
MKIR	0.87079	0.79885	1.00000	-.019092	-0.53309
DIVR	-0.21024	0.38699	-.019092	1.00000	.022270
ERRL	-0.37618	-0.26960	-0.53309	.022270	1.00000

in the analysis, the stepwise procedure regresses the natural logarithms of price relatives on the natural logarithms of the market index relatives. Table 4.2 given below presents a sample output for the first step in the stepwise regression procedure. In particular, the output presented is for the Michigan Seamless Tube Company.

TABLE 4.2

SAMPLE STEPWISE REGRESSION PROCEDURE
STEP I
(MICHIGAN SEAMLESS TUBE)

Regression Analysis

Dependent Variable	PRRL
Residual Standard Deviation	0.0297
Standard Error of the Mean	0.0085
Multiple R	0.8707
Multiple RSQR	0.7582
Variable Entered	MKIR

Variable	B Coef-ficient	Standard Error of Beta	Partial-R	Beta Coef-ficient	Standard Error of Beta
MKIR	1.0989	0.1962	0.8707	0.8707	0.1554
Constant	0.0020				

Analysis of Variance Table

Source	D.F.	Sum of Squares	Mean Square	F
Regression	1	.027833	.027833	31.369
Error	10	.0088727	.00088727	

The information of particular interest included in Table 4.2 follows:

(1) Multiple R, which indicates the degree of relationship between the independent and dependent variable (s).

(2) Multiple R^2, which measures the proportion of the total variation in price change explained by changes in the independent variable (s) (the market index, in this step).

(3) The B-Coefficient represents the least-squares estimate of the responsiveness of price changes to changes in the market index variable. In this case, a one-unit change in the market index would predict a change of 1.0989 units of price relative.

(4) The Partial-R represents an index of the ability of this particular independent variable to explain the variance left unexplained by previously included independent variables. Since in Step I no other variables have been previously included, the partial correlation and the multiple correlation are the same.

(5) The Beta Coefficient represents a normalized value of the B-Coefficient expressed in units of standard deviation of the dependent variable.

(6) The constant term represents the change in price irrespective of changes in the other independent variables.

(7) An Analysis of Variance table shows the division of the variation in price changes between that associated with the independent variable, called Regression Sum of Squares, and the variation of price changes unexplained by the regression function. This latter portion is called error sum of squares. The regression sum of squares divided by the sum of error and regression sum of squares represents the multiple R^2 explained in (2).

(8) The F value is computed by dividing the regression mean square by the error mean square. With one and ten degrees of freedom, $F=31.369$ shows that the explained variance is significant.

Although they are not displayed in the print-out material for Michigan Seamless Tube, the partial correlation coefficients for each of the remaining independent variables are computed with the market variable already entered in the model. The variable with the highest partial correlation coefficient is then selected as a candidate for entrance into the regression model. As discussed in Chapter III, the stepwise procedure provides an advantage over traditional regression analysis by eliminating certain variables from the equation when they are highly intercorrelated. The stepwise procedure eliminates these variables in two separate steps. First, the multiple correlation coefficient of the variable, which is a candidate for inclusion in the regression model, is computed with respect to the other independent variables to determine if near-perfect collinearity is present. Computation of this coefficient is included for mathematical reasons, as previously discussed, and in this study is defined as $R^2 = .98$. If this criterion is exceeded, the variable is not entered into the model. Second, if the inclusion of the variable does not significantly reduce the unexplained variance at the .01 level, the variable is not entered into the model in this study.

Step I entered the market index variable. Table 4.3 presents Step II of the stepwise procedure for the example of Michigan Seamless Tube. In Step II, the dividend variable is entered because it has the next highest correlation coefficient and it significantly improves the explanatory ability of the model. The multiple R of Step II shows that the variance explanation of the model has been improved by the inclusion of the dividend relative.

TABLE 4.3

SAMPLE STEPWISE REGRESSION PROCEDURE
STEP II
(MICHIGAN SEAMLESS TUBE)

Regression Analysis

Dependent Variable	PRRL
Residual Stand Deviation	0.0288
Standard Error of the Mean	0.0083
Multiple R	0.8920
Multiple RSQR	0.7957
Variable Entered	DIVR

Variable	B Coef-ficient	Standard Error of Beta	Partial-R	Beta Coef-ficient	Standard Error of Beta
MKIR	1.0942	0.1901	0.8867	0.8670	0.1506
DIVR	-0.2124	0.1652	-0.3938	-0.1936	0.1506
Constant	0.0053				

Analysis of Variance Table

Source	D.F.	Sum of Squares	Mean Square	F
Regression	2	.029210	.014605	17.535
Error	9	.0074961	.00083290	

In the current example of Michigan Seamless Tube, the second variable entered in the regression equation is the dividend variable, and the third is earnings per share as presented in Step III.

Step III of the procedure shows that the earnings relative was the final independent variable entered into the model. Earnings was entered because it significantly increased the explaratory ability of the model. It was the last variable in the correlation matrix that significantly improved the model. Less than twenty per cent of the variation in price is left unexplained by the model in its final form. The F value shows the variance explanation is significant.

TABLE 4.4

SAMPLE STEPWISE REGRESSION PROCEDURE
STEP III
(MICHIGAN SEAMLESS TUBE)

Regression Analysis

Dependent Variable	PRRL
Residual Standard Deviation	0.0297
Standard Error of the Mean	0.0085
Multiple R	0.8984
Multiple RSQR	0.8071
Variable Entered	ERRL

Variable	B Coef-ficient	Standard Error of Beta	Partial-R	Beta Coef-ficient	Standard Error of Beta
ERRL	0.0366	0.0235	0.2363	0.1262	0.1835
MKIR	1.1792	0.2315	0.8741	0.9343	0.1834
DIVR	-0.2141	0.1703	-0.4061	-0.1952	0.1552
Constant	0.0054				

Analysis of Variance Table

Source	D.F.	Sum of Squares	Mean Square	F
Regression	3	.029629	.0098764	11.64
Error	8	.0070772	.0008846	

The equation in its final form is:

$$\ln \frac{P_{t+1}}{P_t} = .0054 + .0366 \ln \frac{E_{t+1}}{E_t} + 1.1792 \ln \frac{M_{t+1}}{M_t} - .214 \ln \frac{D_{t+1}}{D_t}$$

The ultimate effect of the stepwise method on the inclusion of collinear variables is shown in this final regression equation. This equation does not include the industry index variable for three possible reasons. First, the industry index could be a linear combination of the other three independent variables and, therefore, would not be entered into the model. Second, the explanatory ability of the industry index also could be contained in other independent variables, most notably the market index. Consequently, its inclusion would not significantly reduce the unexplained variance. Third, its inclusion may not reduce the unexplained variance because it is simply not correlated with the dependent variable.

The correlation matrix of Table 4.1 shows that in the present case the correlation between the industry index and the price changes was $R = .638$, and thus reason three is not too likely. However, Table 4.1 also shows that much of the explanatory ability of the industry index was also contained in the market index as indicated by an $R = .798$ value in the correlation matrix. Thus, as reason two suggests, the industry index was eliminated from the model. Because of the nature of the stepwise procedure, the problem of multicollinearity is believed not to have a substantial influence in the computations

The regression equation was successful in explaining much of the price change variation. The coefficient of determination for Michigan Seamless Tube was $R^2 = .80$. Given that the effects of other variables have been accounted for, the adjusted price relatives, i.e., residuals, are more reliable data to draw inferences about the effect on price of new distributions than the raw price data.

The regression residuals for each stock are computed by subtracting from the observed price change, the price change as predicted by the stepwise regression equation. For example, Table 4.5 shows the results of the computation of each of the twelve monthly residuals around the split month for Michigan Seamless Tube.

TABLE 4.5

MONTHLY RESIDUALS FOR
MICHIGAN SEAMLESS TUBE

Case No.	Y Value	Y Estimate	Residual
-5	-0.03140	-0.00041	-0.03098
-4	-0.02840	-0.02643	-0.00196
-3	-0.05490	-0.06138	0.00648
-2	-0.03540	-0.04357	0.00817
-1	0.09860	0.08663	0.01196
Split	0.04400	-0.00360	0.04760
1	-0.03170	-0.03169	-0.00000
2	0.08500	0.09722	-0.01222
3	-0.00740	0.02623	-0.03363
4	0.06510	0.02670	0.03839
5	0.04780	0.05311	-0.00531
6	-0.06890	-0.04039	-0.02850

These residuals represent the observed price changes after adjusting for market and industry stock price trends, and dividends and earnings changes.

Normality Tests for Residuals

This study is concerned with information provided by a new stock distribution via stock split, or stock dividend, together with any additional information implied by the size of the distribution, type of distribution, and market period. Because the purpose of the study is not to examine the price behavior of individual stocks but rather to study the effect on price of the new-distribution process, the data examined are averages and cumulative averages of the adjusted price relatives (residuals) of all stocks in the sample. The use of average residuals has the advantage of minimizing abnormal price behavior associated with a single stock. The cumulative average residual is of interest because it represents the cumulation of the average adjusted price changes from six months before to five months after the new distribution date.

Average and cumulative average residuals for the 122 stocks in the total sample are presented in Table 4.6.

Normality Tests

As stated earlier, a test of normality on the residuals is necessary before standard t and F tests of significance can be performed. If the normality assumption

TABLE 4.6

ADJUSTED PRICE RELATIVES
FOR 122 STOCK SPLITS AND
STOCK DIVIDENDS

Month	Average	Cumulative Average
-5	.00320	.00320
-4	.00262	.00583
-3	.00633	.01215
-2	.01216	.02431
-1	.00217	.02648
Split	.01079	.03727
1	.00240	.03967
2	-.01526	.02440
3	-.00128	.02312
4	.00089	.02401
5	-.01262	.01139
6	-.01143	-.00004

is supported, F and t tests will be used to determine if the residuals, i.e., adjusted price relatives of new-distribution stocks are different from those of stocks not associated with such distributions. In addition, these tests, if appropriate, will also be used to test the hypothesis that residuals of stock-split and stock-dividend securities are not different according to (1) market periods, (2) size of the distribution, and (3) type of distribution, i.e., stock split or stock dividend.

For each of the twelve months studied surrounding the new distribution date, the 122 residuals were arranged in order of magnitude from lowest to highest. The cumulative frequency distribution of the sample was compared with the cumulative frequency expected from a normally distributed population. The Kolmorogov-Smirnov D[55] statistic, which measures the difference between the sample cumulative frequency and the normal distribution cumulative frequency, was computed for each sixth observation in the distribution for each month. The maximum D values, which are the maximum differences for the comparisons between the sample cumulative frequency and the normal distribution cumulative frequency for each month, are presented in Table 4.7. The .01 and .05 criterion values are also given. If the population is normal, only five times in one hundred would the maximum D value exceed .0794 and only once in one hundred times would the values exceed .0933.

Results of the Kolmogorov-Smirnov test for normality of each of the monthly distributions of residuals are presented in Table 4.7. The data in Table 4.7 show that eight of the distributions are significantly different from normal. Furthermore, the D value computed here is conservative. Massey[56] has shown that grouping observations into intervals tends to lower the value of the maximum D. Such a bias would clearly be incurred in the current study since only one-sixth of the observations are included in the computations of the maximum D. Since only the maximum value

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[55] Hubert Lilliefors, "On the Kolmorogov-Smirnov Test for Normality with Mean and Variance Unknown," 404-19.

[56] Frank J. Massey, "The Kolmogorov-Smirnov Test for Goodness of Fit," American Statistical Association Journal, (March, 1951), p. 72.

TABLE 4.7

TEST OF NORMALITY FOR 122 STOCK SPLIT AND STOCK DIVIDEND RESIDUALS BASED ON KOLMOGOROV-SMIRNOV TEST

Month	Mean	Standard Deviation	D Value
-5	.00320	.0596	.0620
-4	.00262	.0799	.0836
-3	.00623	.0607	.1090
-2	.01216	.0633	.0904
-1	.00217	.0618	.0594
Split	.01079	.0705	.1143
1	.00240	.0496	.2101
2	-.01526	.0716	.0888
3	-.00128	.0731	.1169
4	.00089	.0666	.0900
5	-.01262	.0649	.0681
6	-.11433	.0672	.0477

Critical Values for D

a =	.05	0.1
D_m =	.0794	0.0933

is used in the test, the inclusion of more D computations could not reduce the maximum D. However, the value of maximum D could very well be increased, which would only worsen already unacceptable results relative to normality. Consequently, an assumption of normality for the residuals is not supported by this test.

Further inferences in regard to normality can be made by utilizing a test suggested by Tippett[57] and employed by

[57]Tippett, "On the Extreme Individuals and the Range of Samples Taken From a Normal Population," pp. 364-87.

Fama[58] in regard to minimum and maximum values in the samples. Tippett calculates probability distributions for maximum and minimum values of samples of various sizes drawn from a normal population. His calculations permit approximations of the significance level of minimum and maximum values for each of the twelve distributions. The appropriate significance levels for the monthly distributions are given in Table 4.8.

Columns (1) and (2) of Table 4.8 show the month and the minimum and maximum values, respectively, for each distribution. Column (3) of the Table shows the standardized value and represents the difference between the minimum or maximum value and the mean of the appropriate monthly distribution expressed in units of standard deviation. Column (4) shows the approximate probability that the minimum value of the sample would be larger than the minimum value of the normally distributed population, or that the maximum value of the sample would be smaller than the maximum value of a normally distributed population. Most of the probabilities are large enough for one to suspect that the distributions are not normal.

As suggested earlier, because test results reported above cast serious doubts on the normality of the residuals, non-parametric tests are needed. Data comparisons will be made by means of the Kruskal-Wallis H test when differences between data groupings are not obvious.[59]

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[58]Fama, "The Behavior of Stock-Market Prices," p. 51.

[59]Bradley, Distribution-Free Statistical Tests, p. 129.

TABLE 4.8

TIPPETT PROBABILITIES OF EXTREME VALUES

Month	Value	Standardized Value	Probability (Normal)
		Minimum Values	
-5	-.3418	-5.7849	.9999
-4	-.3081	-3.8850	.9952
-3	-.2233	-3.7798	.9892
-2	-.2496	-4.1352	.9979
-1	-.2009	-3.2815	.9335
Split	-.2034	-3.0349	.8736
1	-.2207	-4.4906	.9996
2	-.1883	-2.4157	.4390
3	-.1933	-2.6266	.6267
4	-.2041	-3.0754	.9073
5	-.2521	-3.6876	.9892
6	-.2686	-3.8224	.9927

Month	Value	Standardized Value	Probability (Normal)
		Maximum Values	
-5	.1632	2.6841	.6267
-4	.2247	2.7770	.7065
-3	.2418	3.8761	.9952
-2	.2237	3.3416	.9527
-1	.2124	3.3970	.9668
Split	.2154	2.8988	.8296
1	.1462	2.8951	.8296
2	.2576	3.8086	.9927
3	.3691	5.0641	.9999
4	.1905	2.8459	.7746
5	.1570	2.6104	.6267
6	.1894	2.9847	.8296

Effect of Stock Distribution

The first comparison made compares the adjusted price changes of stocks associated with splits and stock dividends with the price changes of the control group. Table 4.9 presents the average and cumulative average residuals for the 122 split and stock dividend firms and also the residuals for the previously discussed random sample of 122 stocks that did not split or process large stock dividends. Stocks associated with new distributions exhibit a definite pattern. First, there are no negative residuals during those months' preceding the new distribution. This result suggests that prices for the new-distribution securities are higher than can be accounted for on the basis of dividends, earnings and industry and general stock prices. Second, the greatest positive

TABLE 4.9

ADJUSTED PRICE RELATIVES OF 122 STOCK SPLIT AND STOCK DIVIDEND COMMON STOCKS AND 122 COMMON STOCKS THAT DID NOT PROCESS SPLITS OR STOCK DIVIDENDS

	Average		Cumulative	
Month	Stock Splits and Dividends	Control Stocks	Stock Splits and Dividends	Control Stocks
-5	.00320	.00005	.00320	.00005
-4	.00263	-.00655	.00583	-.00650
-3	.00632	.00901	.01215	.00251
-2	.01216	.00245	.02431	.00496
-1	.00217	-.00362	.02648	.00134
Split	.01079	-.00825	.03727	-.00691
1	.00240	-.00547	.03967	-.01238
2	-.01527	.00795	.02440	-.00443
3	-.00128	.00535	.02312	.00092
4	.00089	.00275	.02401	.00367
5	-.01262	.00512	.01139	.00889
6	-.01143	-.00881	-.00004*	+.00008*

*due to rounding

average residuals occurred during the new distribution month and months -2 and -3. Inasmuch as most announcements of forthcoming splits and large stock dividends tend to occur in these months, i.e., -2 and -3, apparently this information is important to the market. Third, the actual new distribution has a dramatic effect on the price relative, indicating that the distribution process itself, aside from the announcement, has considerable information content.

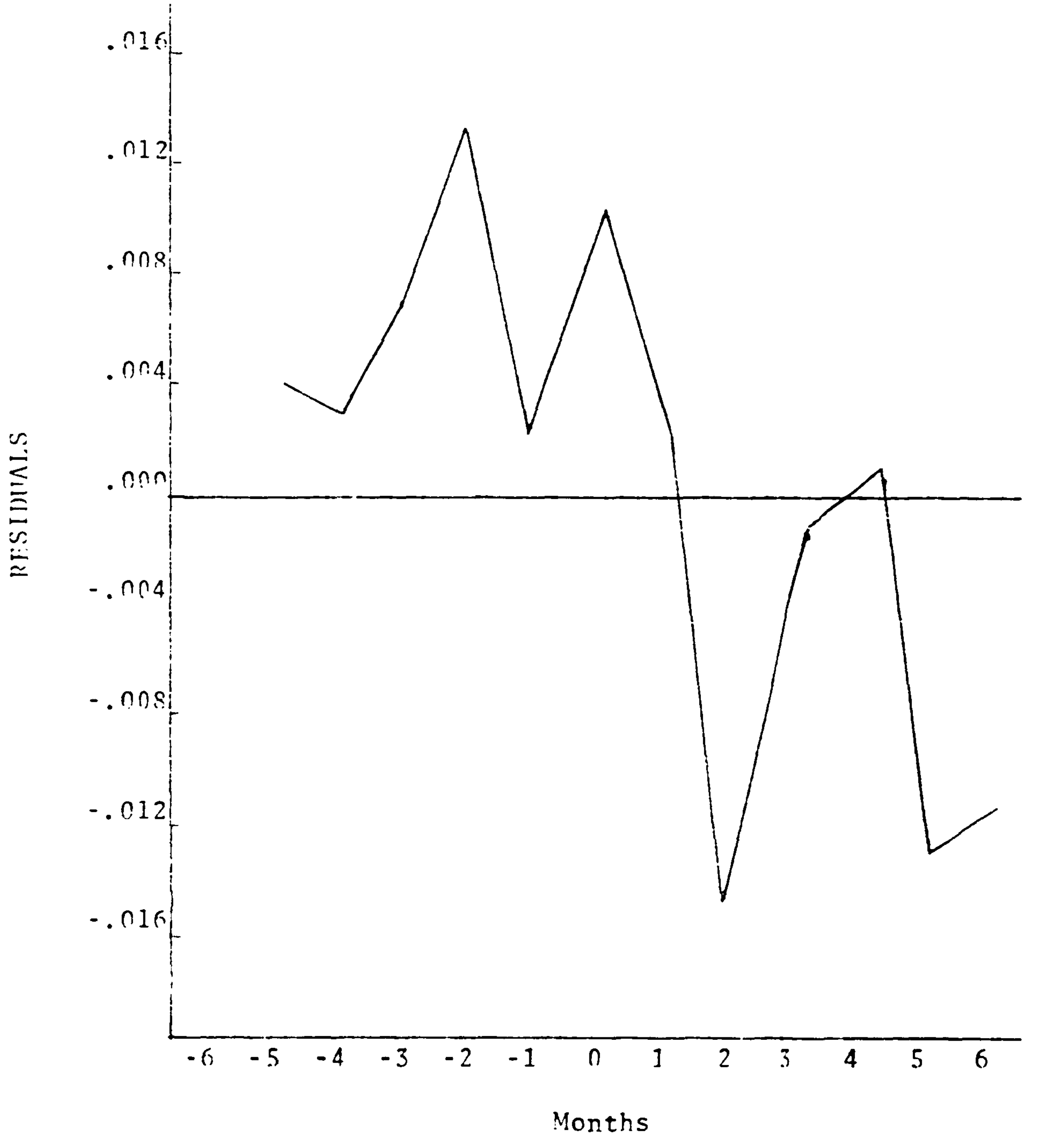
The above comments, based on Table 4.9, are further illustrated in Graph II. Table 4.9 and Graph II show that for the new distribution securities, there are two months when the residuals, although positive, are markedly less than the preceding month. This change occurs directly following the announcement and the split months. The price performance implied by the residual suggests that the market is reacting to an initial overbullish valuation.

Turning attention to the cumulative residuals, Table 4.9 and Graph III suggest obvious patterns within the stock split and stock dividend group. The cumulative residuals increase constantly from the first date recorded to the month following the new distribution, and then they decline. The highest positive cumulative residual occurs immediately following the distribution.

The control stocks have residual values that seem to be randomly distributed about the regression estimates. No obviously discernible pattern appears to exist in the control

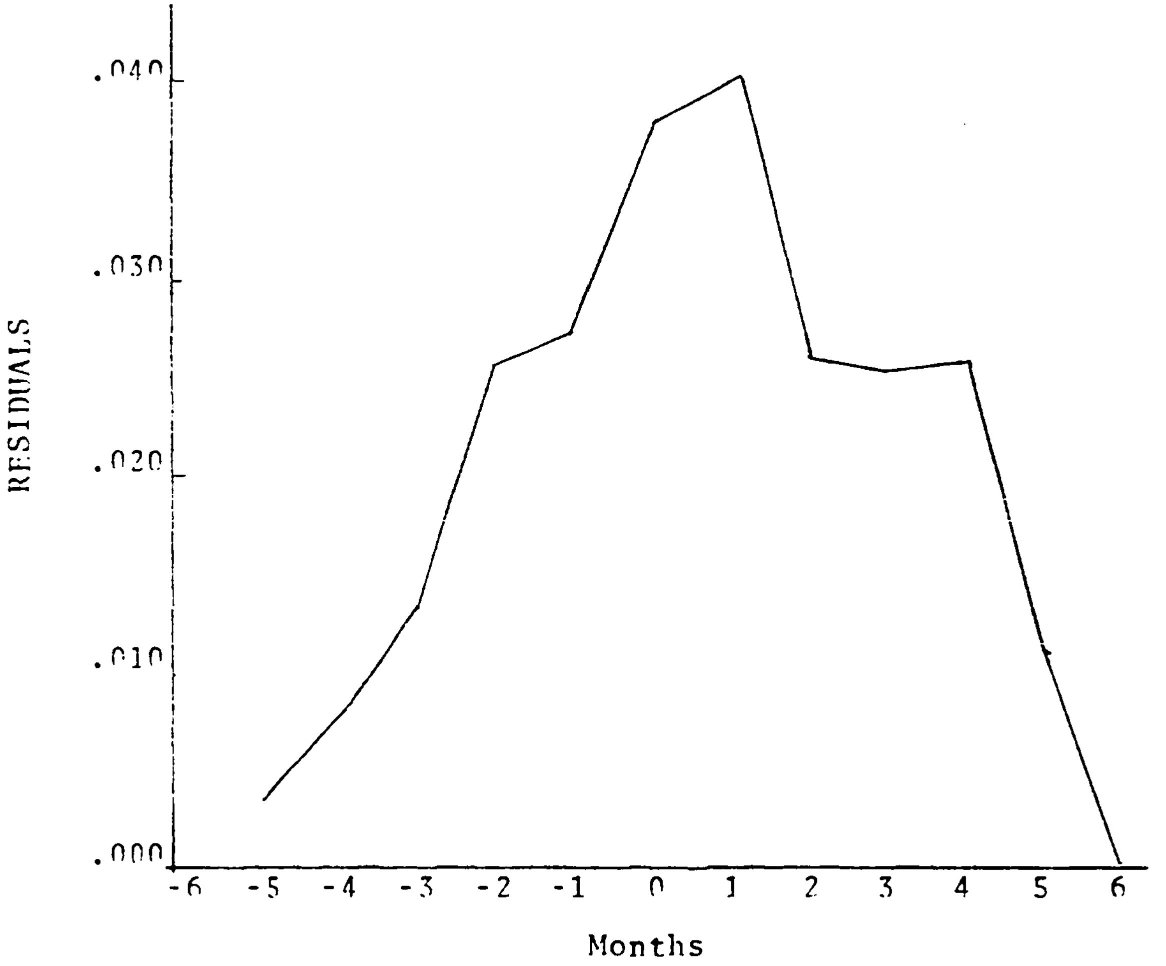
GRAPH II

AVERAGE ADJUSTED PRICE RELATIVES (RESIDUALS)
OF 122 STOCK SPLITS AND STOCK DIVIDENDS



GRAPH III

CUMULATIVE AVERAGE ADJUSTED PRICE RELATIVES
(RESIDUALS) OF 122
STOCK SPLITS AND STOCK DIVIDENDS



group. Graphs IV and V show this lack of pattern in the prices of the control group.

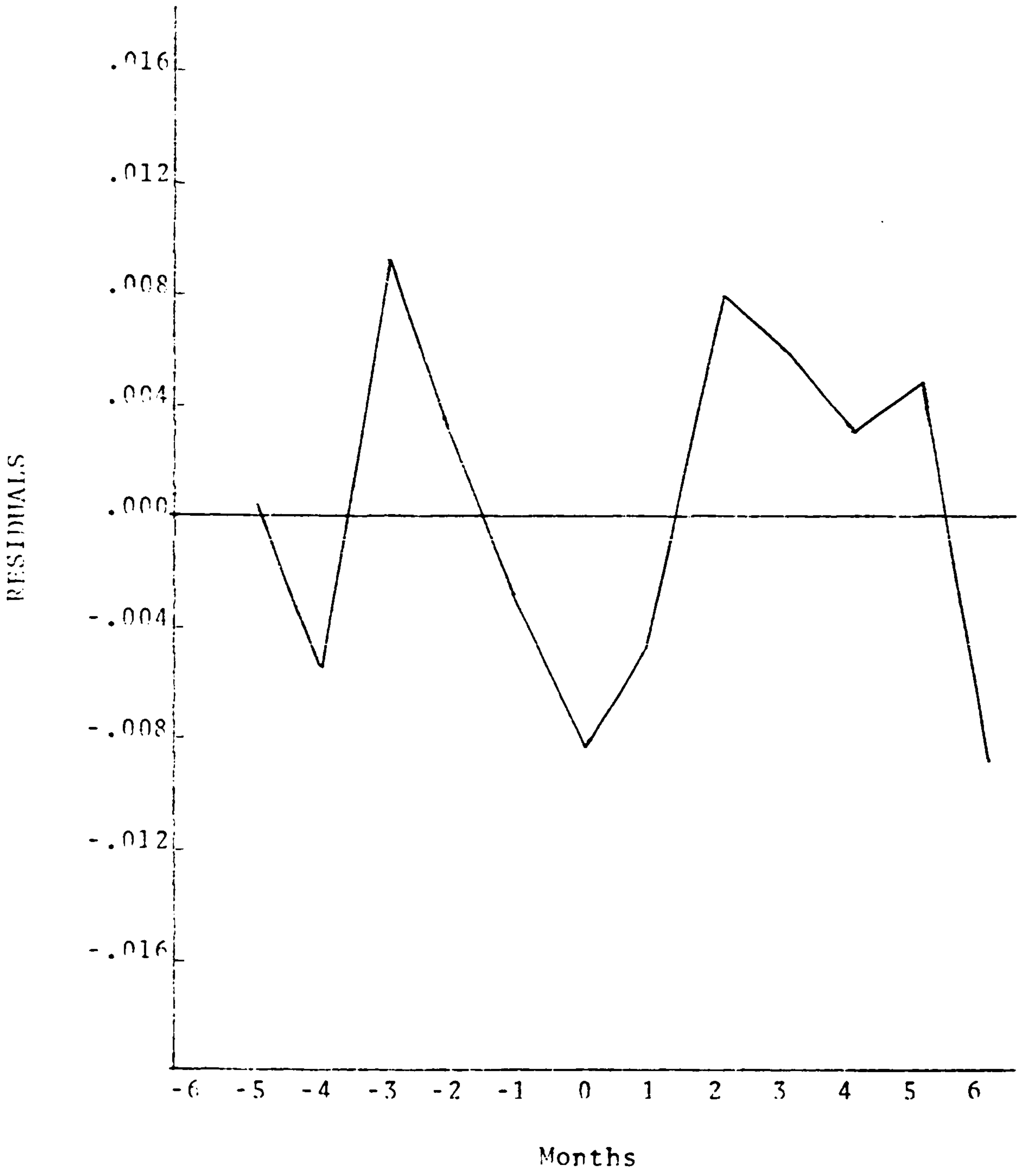
The tables and graphs of the residual data for the new distribution sample relative to the control sample show that the price performance of the two samples differs significantly. In fact, the differences are significantly obvious that no statistical test is deemed necessary. Although residuals for all months preceding the new distribution were positive, the greatest positive effects occurred at the announcement and split months. The fact that further price increases occurred at the new distribution date indicates that the distribution itself, in addition to the announcement, is also associated with new information.

The Effect of Market Periods

The comparisons of securities having new distributions with a control group that did not possess new distributions showed that a significant difference exists between the price actions of stocks that split or process stock dividends and those that do not. Therefore, exploring more fully the price performance of the new-distribution securities seems desirable. One useful comparison is the type of market period in which the new distribution occurred. The cumulative residuals of the 122 new-distribution securities were grouped according to market periods, i.e., bull, bear, and no-change. Examination of Table 4.10 suggests that the market period characterized by the highest (positive) cumulative residuals is the no-change

GRAPH IV

AVERAGE ADJUSTED PRICE RELATIVES
(RESIDUALS) OF 122 STOCKS



GRAPH V

CUMULATIVE AVERAGE ADJUSTED PRICE RELATIVES
(RESIDUALS) OF 122 STOCKS

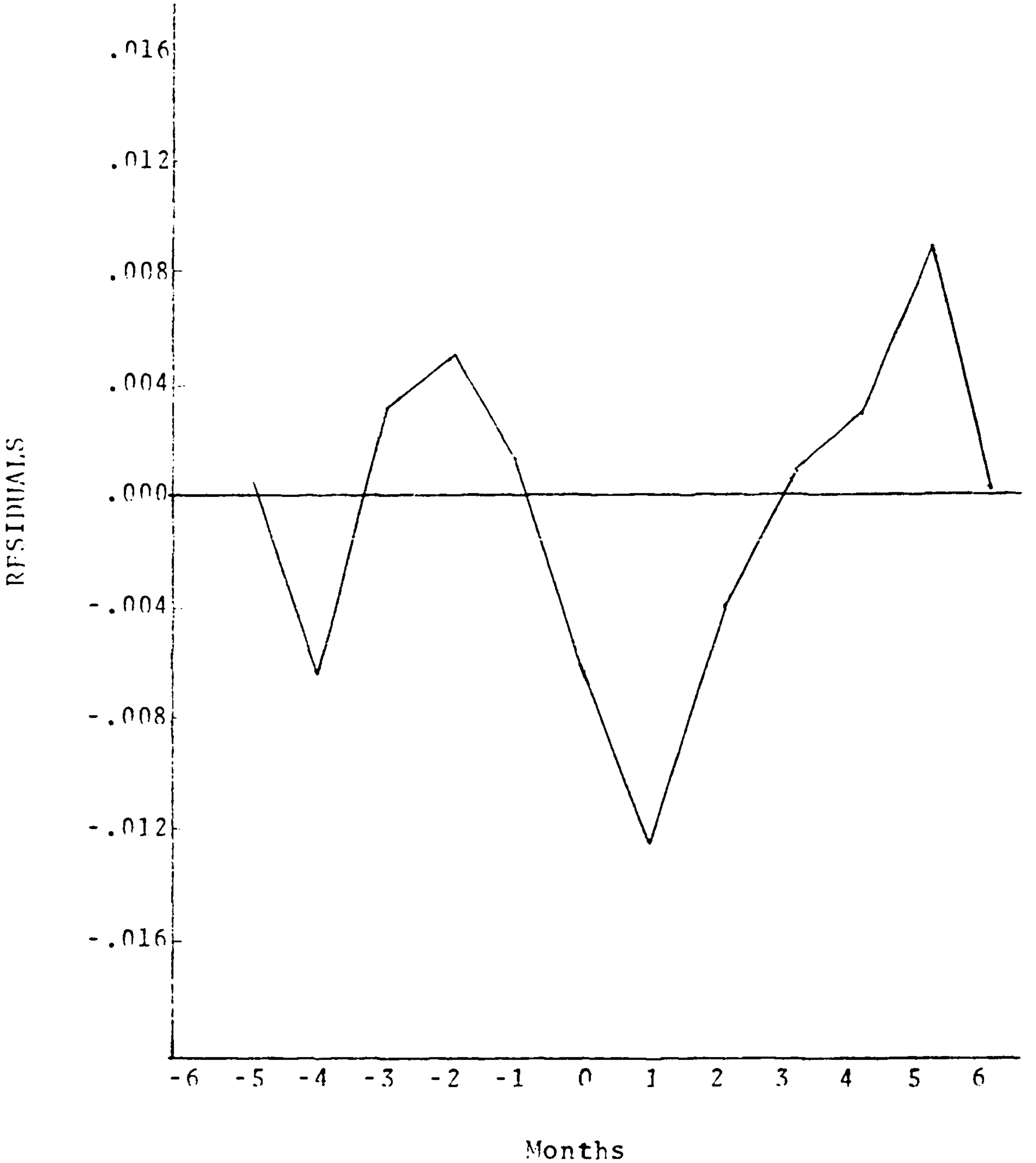


TABLE 4.10

KRUSKAL-WALLIS TEST OF CUMULATIVE RESIDUALS BY MARKET PERIOD

Month	Bear	Rank	Bull	Rank	No-Change	Rank
-5	.00431	10	-.00454	3	.00932	15
-4	-.00536	2	.00663	12	.01603	20
-3	-.00799	1	.02922	27	.01599	19
-2	.00630	11	.02123	25	.04479	31
-1	.01917	23	.01686	21	.04259	30
Split	.02785	26	.02094	24	.06169	35
1	.01822	22	.03476	29	.06525	36
2	.00725	13	.00954	16	.05502	33
3	.00076	8	.01014	17	.05708	34
4	.00854	14	.01530	18	.04728	32
5	.00297	4	.00284	9	.03349	28
6	.00000	6	.00000	6	.00000	6
T_i		140		207		319
n_i		12		12		12

Criterion	.05	.01
	5.99	9.21

Test Results

Kruskal-Wallis H = 12.14

market. More specifically, Table 4.10 shows that the positive cumulative deviation from the expected price is greatest for the no-change market in ten of the months surrounding the distribution. On the other hand, the lowest cumulative residuals occur for stocks processing distributions during the bear-market period. In eight of the months, the lowest residuals appear in the bear market.

In an effort to determine if a significant difference exists between market periods, the Kruskal-Wallis H test is performed. The magnitudes of T_i, which is the sum of the ranks, indicate that the largest residuals occur during the no-change market. The Kruskal-Wallis test indicates there is a significant difference in residuals among market periods.

The Effect of Descriptive Terminology

As indicated earlier, the American Institute of Certified Public Accountants and the New York Stock Exchange are concerned with the connotation of the term "dividend" to describe some stock distributions. The implication is that significant information is conveyed to the market when this term is used. The term "dividend" has been traditionally defined as a payment or distribution of assets to the stockholder, while a "split" may simply imply a recapitalization. If indeed this is the case, those distributions termed "dividends" might be expected to outperform "splits".

To determine if any effect on price is attributable to the terminology used to describe the new distribution, the residuals for the 122 stocks were grouped as stock splits or stock dividends according to the descriptive terminology employed by Moody's, Value-Line, and Financial World Investment Services. The classification of stock split or stock dividend does not necessarily depend on the accounting treatment used, but only on the terminology used by these services. For example, if the process was referred to as a 100 per cent distribution or a "stock dividend", it was classified as a dividend. On the other hand, if the description of the distribution contained the phrase "two-for-one" or "split", it was classified as a stock split.

Table 4.11 and the Kruskal-Wallis H test show that, over the total time period studied, a significant difference exists between the groups. This result supports the hypothesis that the term "dividend" implies information which is not suggested by the term "split".

TABLE 4.11

KRUSKAL-WALLIS TEST OF THE CUMULATIVE RESIDUALS OF STOCK SPLITS AND STOCK DIVIDENDS

	Stock Splits		Stock Dividends	
Month	Cumulative	Rank	Cumulative	Rank
-5	.00146	5	.00639	8
-4	-.00411	1	.02409	15
-3	.00513	7	.02503	16
-2	.01450	13	.04231	18
-1	.00771	10	.06096	21
Split	.00997	11	.08030	23
1	.01612	14	.08297	24
2	.00674	9	.05688	20
3	-.00127	2	.06798	22
4	.01259	12	.04504	19
5	.00394	6	.02519	17
6	.00001	3½	-.00003	3½
T_i		93½		206½
n_i		12		12

Criterion	.05	.01
	3.84	6.63

Test Results

Kruskal-Wallis H = 10.45

The Effect of the Distribution Size

As discussed in a previous section, both the American Institute of Certified Public Accountants and the New York Stock Exchange assume that the size of a stock distribution has implications for stock prices. In other words, some information concerning the price of a security is implied by the size of the stock distributions.

Since the previous section disclosed that the residuals of "splits" are different from those of "dividends," the effects of the size of the distribution for "splits" and the effects of the size of the distribution for "stock dividends" are examined separately over the entire time interval.

Stock Splits

The residuals for stock-split securities over the total time period were grouped according to four distribution sizes. The cumulative residuals of the groups were compared by means of the Kruskal-Wallis H statistic. These four distribution classes were based on the percentage increase in the number of shares: (1) six-for-five to less than three-for-two, i.e., a 20 per cent to 49 per cent increase in shares; (2) three-for-two to less than two-for-one, i.e., a 50 per cent to 99 per cent increase in shares; (3) two-for-one, i.e., a 100 per cent increase in shares; and (4) greater than two-for-one, i.e., a greater than 100 per cent increase in shares.

The data of Table 4.12 and the Kruskal-Wallis H test show a significant difference between the cumulative residuals based on these distribution sizes. The largest residuals occurred in the 50-99 per cent group. This result is shown by the value $T_i = 444\frac{1}{2}$. An examination of the 100 per cent and greater than 100 per cent groupings shows little difference between these groups, i.e., $T_i = 228$ and 224. Noteworthy is the finding that the cumulative residuals for distributions less than 100 per cent are greater than those of larger distribution sizes. This finding lends support to the New York Stock Exchange rulings regarding accounting treatment based on size of the distribution. As discussed in Chapter I, the New York Stock Exchange has predicated its listing policies on the assumption that distributions that double or more than double the outstanding shares require no special adjustment to retained earnings. Those distributions resulting in less than double the number of shares are examined in greater detail by the Exchange to determine if retained earning should be capitalized. The rank sums of Table 4.12 indicate that 100 per cent and greater distributions differ in price from smaller distributions; therefore, different accounting treatments may be justified.

Stock Dividends

Residuals for stock-dividend securities for the entire time period are grouped according to the same distribution sizes as given above in connection with stock splits. The

TABLE 4.12

KRUSKAL-WALLIS TEST OF CUMULATIVE RESIDUALS
FOR STOCK SPLITS BY SIZE OF DISTRIBUTION

	(20-49 per cent)		(50-99 per cent)		(100 per cent)		(Greater than 100 per cent)	
Month	Cumulative	Rank	Cumulative	Rank	Cumulative	Rank	Cumulative	Rank
-5	-.00291	14	-.00468	11	.00566	27	-.01380	6
-4	-.00296	13	-.00198	17	-.00794	8	.01559	33
-3	.00175	25	.02152	40	.00343	26	-.00283	15
-2	.01931	38	.03020	41	.01842	36½	-.03079	1
-1	.01581	35	.07495	45	-.00299	12	-.01482	5
Split	.01842	36½	.09620	48	.00100	23	-.01219	7
1	.01293	32	.09206	46	.00102	24	.01562	34
2	-.01979	2	.09247	47	-.00707	9	-.00049	18
3	.00822	29	.06751	44	-.01603	4	-.0021	16
4	-.01683	3	.06143	43	.00584	28	.00962	30
5	.01112	21	.03021	42	-.00487	10	.02059	39
6	.00001	20	-.00001	20½	-.00002	20½	-.00000	20½
T_i		279		444½		228		224½
n_i		12		12		12		12

Criterion	.05	.01
	7.81	11.34

Test Results

Kruskal-Wallis H = 13.5

Kruskal-Wallis H statistic presented in Table 4.13 shows no significant difference between the residuals based on the four distribution sizes examined. Evidently, market price is similarly affected by stock dividends regardless of the size of the distribution.

Some similarity between the stock dividend and stock split results is exhibited by the fact that in both cases the 50 to 99 per cent distribution size is characterized by the largest cumulative residuals, shown by $T_i = 348$. Therefore, the distribution size resulting in the most favorable cumulative price changes, i.e., favorable relative to the expected price, is the 50 to 99 per cent range. In addition, the distribution size most often encountered, i.e., 100 per cent and two-for-one is characterized by unfavorable price changes relative to the other distribution sizes studied. The result tends to indicate that information provided by a doubling of the shares is not as bullish as that from distribution sizes other than 100 per cent and two-for-one.

Effect of Size and Terminology

A more detailed study of the effects of size and terminology is contained in Tables 4.14, 4.15, 4.16 and 4.17. These tables present tests of the difference between stock splits and stock dividends over the total time period at four different distribution sizes. The data show a significant difference between stock splits and stock dividends at all distribution levels except 50 to 99 per cent.

TABLE 4.13

KRUSKAL-WALLIS TEST OF CUMULATIVE RESIDUALS
FOR STOCK DIVIDENDS BY SIZE OF DISTRIBUTION

	(20-49 per cent)		(50-99 per cent)		(100 per cent)		(100 per cent)	
Month	Cumulative	Rank	Cumulative	Rank	Cumulative	Rank	Cumulative	Rank
-5	.00727	8	-.03478	1	.02452	15	.01184	9
-4	.01903	12	.01747	11	.03204	18	.02349	14
-3	-.00666	2	.06178	33	.02573	16	.05287	28
-2	.04544	22	.08259	42	.01496	10	.05681	31
-1	.07897	41	.05528	29	.04247	21	.07896	40
Split	.08384	43	.10365	45	.05280	27	.10384	46
1	.07633	39	.10521	47	.07060	37	.10575	48
2	.07148	38	.04931	24	.05003	25	.05025	26
3	.05573	30	.10330	44	.06288	35	.06234	34
4	.03873	20	.06619	36	.04552	23	.02761	17
5	.00644	7	.05965	32	.02146	13	.03472	19
6	.00000	4½	.00000	4½	.00000	4½	.00000	4½
T_i		266½		348½		244½		316½
n_i		12		12		12		12

Criterion	.05	.01
	7.81	11.34

Test Results

Kruskal-Wallis H = 2.7

TABLE 4.14

KRUSKAL-WALLIS TEST OF CUMULATIVE RESIDUALS OF STOCK SPLIT AND STOCK DIVIDEND SECURITIES WITH 20-49 PER CENT DISTRIBUTIONS

	Stock Splits		Stock Dividends	
Month	Residuals	Rank	Residuals	Rank
-5	-.00291	5	.00727	10
-4	-.00296	4	.01903	16
-3	.00175	8	-.00666	3
-2	.01921	17	.04544	19
-1	.01582	14	.07897	23
Split	.01842	15	.08384	24
1	.01293	13	.07633	22
2	-.01979	1	.07148	21
3	.00822	11	.05573	20
4	-.01683	2	.03873	18
5	.01112	12	.00644	9
6	.00001	6½	.00000	6½
T_i		108½		191½
n		12		12

Criterion	.05	.01
	3.84	6.63

Test Results

Kruskal-Wallis H = 5.74

Table 4.14 presents a comparison of the cumulative price changes of stock dividends of 20 to 49 per cent distribution sizes with stock splits from six-for-five to less than three-for-two. The Kruskal-Wallis H statistic shows that these residual groups are significantly different at the .05 level of significance.

TABLE 4.15

KRUSKAL-WALLIS TEST OF CUMULATIVE RESIDUALS
OF STOCK SPLIT AND STOCK DIVIDEND SECURITIES
WITH 50-99 PER CENT DISTRIBUTIONS

	Stock Splits		Stock Dividends	
Month	Residuals	Rank	Residuals	Rank
-5	-.00468	2	-.03478	1
-4	-.00198	3	.01747	6
-3	.02152	7	.06178	14
-2	.03020	8	.08259	18
-1	.07495	17	.05528	11
Split	.09620	21	.10365	23
1	.09206	19	.10521	24
2	.09247	20	.04931	10
3	.06751	16	.10330	22
4	.06143	13	.06619	15
5	.03021	9	.05965	12
6	-.00001	4½	.00000	4½
T_i		139½		160½
n				

Criterion	.05	.01
	3.84	6.63

Test Results

Kruskal-Wallis H = 0.34

Table 4.15 presents a comparison of the cumulative price changes of split and stock dividend securities with distributions resulting in total share increases that are as great as 50 per cent but less than 100 per cent. The Kruskal-Wallis test shows that they do not differ.

TABLE 4.16

KRUSKAL-WALLIS TEST OF CUMULATIVE RESIDUALS OF STOCK SPLIT AND STOCK DIVIDEND SECURITIES WITH 100 PER CENT DISTRIBUTION

	Stock Splits		Stock Dividends	
Month	Residuals	Rank	Residuals	Rank
-5	.00566	11	.02452	16
-4	-.00794	2	.03204	18
-3	.00343	10	.02573	17
-2	.01842	14	.01496	13
-1	-.00299	5	.04247	19
Split	.00100	8	.05280	22
1	.00102	9	.07060	24
2	-.00707	3	.05003	21
3	-.01603	1	.06288	23
4	.00584	12	.04552	20
5	-.00487	4	.02146	15
6	-.00002	6½	.00000	6½
T_i		85½		214½
n_i		12		12

Criterion	.05	.01
	3.84	6.63

Test Results

Kruskal-Wallis H = 13.84

The results of Table 4.16 show that two-for-one splits are different from 100 per cent stock dividends with respect to cumulative stock prices. Those distributions referred to as stock dividends have higher cumulative price changes than splits. This is shown by the rank sums of 214½ for stock dividends and 85½ for splits.

TABLE 4.17

KRUSKAL-WALLIS TEST OF CUMULATIVE RESIDUALS OF STOCK SPLIT AND STOCK DIVIDEND SECURITIES WITH GREATER THAN 100 PER CENT DISTRIBUTIONS

	Stock Splits		Stock Dividends	
Month	Residuals	Rank	Residuals	Rank
-5	-.01380	3	.01184	11
-4	.01559	12	.02349	15
-3	-.00283	5	.05287	19
-2	-.03079	1	.05681	20
-1	-.01482	2	.07896	22
Split	-.01219	4	.10384	23
1	.01562	13	.10575	24
2	-.00049	7	.05025	18
3	-.00214	6	.06234	21
4	.00962	10	.02761	16
5	.02059	14	.03472	17
6	.00000	8½	.00000	8½
T_i		85½		214½
n_i		12		12

Criterion	.05	.01
	3.84	6.63

Test Result

Kruskal-Wallis H = 13.84

Table 4.17 compares those splits and stock dividend prices for distribution sizes greater than two-for-one and 100 per cent. These results are the same as those of Table 4.16. Again, the stock dividend cumulative price changes are larger than those of the splits.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The effect of stock splits and stock dividends on the market price of common stocks continues to be controversial. On the one hand, some scholars argue that the occurrence of stock splits and stock dividends in and of themselves causes changes in the prices of securities. On the other hand, other scholars claim that stock distributions merely imply information about other fundamental variables, such as dividends and earnings, and that any price action in securities is attributable to expected changes in these variables and not to stock distributions *per se*.

This paper has studied the information content of stock splits and stock dividends regarding the market price of the firm's common stock. Several areas were considered concerning information potential for the investor. In particular, the study has shown that: (1) price behavior attending stock-split and stock-dividend securities is different from the price behavior of securities which did not have new stock distributions; (2) price behavior of new-distribution stocks differs according to the type of market period (i.e., bull, bear and no-change) in which the distribution occurs; specifically, the most favorable price action occurs during the no-change period; (3) price behavior attending new stock distributions described as "stock dividends" is more favorable than price behavior for distributions described as "stock splits;" and (4) the size of the new stock distribution has an effect on stock price behavior.

Prior Studies

Several scholars have attempted to study the influence of stock splits and stock dividends on the market price of securities. Barker reported that price increases associated with stock-split and stock-dividend securities was attributable to increases in cash dividends rather than to new distributions.[59] However, Barker's results may be misleading because he did not account for changes in security prices resulting from changes in other variables, such as earnings and general stock market price changes.

Johnson compared the thirteen-month price changes of a sample of 74 split stocks with a control group of 74 stocks that did not experience new distributions.[60] Holding constant such factors as earnings, dividends and industry stock price trends, he concluded that split stocks exhibited changes in price that were not explained by cash dividend changes.

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[59]Barker, "Effective Stock Splits," pp. 101-06.
Barker, "Stock Splits in a Bull Market," pp. 72-79.
Barker, "Evaluation of Stock Dividends," pp. 99-113.

[60]Johnson, "Stock Splits and Price Changes," pp. 675-86.

Further, Johnson claimed that the split itself explained some of the security price movement. However, Johnson's study did not control for general stock market price trends; also, the stocks examined were selected from one bull-market period, i.e., the year 1959.

Fama, et al., studied the monthly returns surrounding 940 splits and stock dividends of 25 per cent or greater from 1927 through 1959.[61] The data studied were the residuals from a regression function of observed returns on Fisher's Combination Investment Performance Index. These residuals were examined from 30 months preceding the split month to 30 months following the split month. The Fama, et al., study concluded that abnormal price behavior was associated with stock-split and stock-dividend securities. Also, they supported Barker's conclusion that this price behavior was merely a reflection of information concerning the probability of a favorable change in cash dividends.

The Fama, et al., study did not account for changes in earnings and industry factors, nor did it differentiate between splits and stock dividends. Differences in the size of the distribution were not considered. Finally, no consideration was given to the type of stock market period in which the distribution occurred, i.e., bear, bull or no-change.

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[61] Fama, et al., "The Adjustment of Stock Prices to New Information," pp. 1-21.

Sample of Stocks

The present study is an empirical examination of new-distribution securities. The original sample consisted of 150 stocks that split or processed stock dividends of 20 per cent and greater in three distinct market periods. The calendar year 1964 was considered a bull-market period; therefore, 50 stocks were selected from that period. Fifty stocks were also selected from the year 1966 and from the year June, 1967, through May, 1968; these time periods were considered to be representative of bear and no-change market periods, respectively. The final sample consisted of 122 securities --- 39 in the bull, 41 in the bear, and 42 in the no-change market periods. Several stocks in each group were excluded from the final sample because they were associated with multiple distributions or with mergers, or because they were not listed on the exchange for the full study period.

Method of Stock Price Adjustment

The monthly price relatives of stocks from six months preceding the date of the new distribution to six months following the date of the new distribution were considered. Estimated monthly stock price relatives were computed for monthly changes in earnings, dividends, specific industry, and general stock market price trends via a multiple regression model. Adjusted monthly price relatives were then computed for each of the stocks in the study. Specifically, the adjusted price changes are the regression residuals, which were computed as follows:

$$\ln \frac{P_{jt}}{P_{jt-1}} = B_1 + B_2 \ln \frac{D_{jt}}{D_{jt-1}} + B_3 \ln \frac{E_{jt}}{E_{jt-1}} + B_4 \ln \frac{I_{jt}}{I_{jt-1}} + B_5 \ln \frac{M_t}{M_{jt-1}} + u_{jt}$$

Therefore,

$$u_{jt} = \ln \frac{P_{jt}}{P_{jt-1}} - \left(B_1 + B_2 \ln \frac{D_{jt}}{D_{jt-1}} + B_3 \ln \frac{E_{jt}}{E_{jt-1}} + B_4 \ln \frac{I_{jt}}{I_{jt-1}} + B_5 \ln \frac{M_t}{M_{jt-1}}\right)$$

where:

P_{jt}/P_{jt-1} = change in the price per share of the j^{th} stock at time t,

D_{jt}/D_{jt-1} = change in the dividend per share of the j^{th} stock at time t,

E_{jt}/E_{jt-1} = change in the earnings per share of the j^{th} stock at time t,

I_{jt}/I_{jt-1} = change in Standard and Poor's Sub-Industry Stock Price Index associated with the j^{th} stock at time t,

M_t/M_{jt-1} = change in Standard and Poor's Common Stock Price Index for 425 Industrial Common Stocks at time t, and

u_{jt} = error, i.e., residual or adjusted price relative of the j^{th} stock at time t.

Various regression procedures are available for statistically defining an explanatory function. The stepwise procedure was selected for this study for two reasons: First, considerable controversy accompanies existing theoretical stock price models.

Debate continues concerning the relative importance of earnings versus dividends, etc. Hence, the stepwise procedure is an attempt to utilize the "best" variables. Second, the stepwise procedure has the ability to limit the degree of multicollinearity which may exist within the model. Using the stepwise procedure, if one independent variable is a linear combination of other independent variables, it is not entered into the model. In addition, if two variables explain the same variation in price, one will be excluded from the model. Consequently, although the stepwise procedure is not expected to completely eliminate collinearity between and among independent variables, the final function can be expected to contain less collinearity than if traditional regression analysis were used.

Normality Tests

The results of some recent studies in financial literature have indicated that adjusted stock price relatives, i.e., regression residuals, are non-Gaussian members of the stable Paretian family of distributions.[62] The implication of this result is that the variances of these distributions are "infinite." Therefore, standard F and t statistics, which are based on finite variances, may not be appropriate for comparing various groupings of residuals. For this reason, the residuals

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[62]Fama, et al., "The Adjustment of Stock Prices to New Information," pp. 1-21.

were tested for normality with the Kolmogorov-Smirnov and Tippett tests. These test results indicated that the adjusted price changes are not normally distributed; therefore, comparisons were made on the basis of the nonparametric Kruskal-Wallis H statistic.

Tests of the Data

To compare the price changes of stocks having new distributions with stocks not having new distributions, a control sample was selected from Moody's Handbook of Common Stocks for the same three time periods as the new-distribution sample, with their price changes subjected to the same adjustments given above.

The adjusted price changes for the split and stock dividend securities were compared to the adjusted price changes of the control sample. The adjusted monthly price changes of the new-distribution securities exhibited a pattern different from that of the control sample securities. The adjusted price changes were positive in the months preceding the new distribution and negative for the months following the new distribution, whereas the control group's adjusted price changes were randomly distributed about a zero price change.

Once the determination was made that the price performance of new-distribution securities was different from the price performance of securities not processing new-stock distributions, additional analysis of the new-distribution securities seemed warranted. Specifically, the following comparisons were made:

(1) The price performances of new-distribution securities were compared according to type of market period, i.e., bull versus bear versus no-change; (2) The price performances of stock-split and stock-dividend securities were compared; (3) The price performances of different sized stock split distributions were compared; (4) The price performance of different sized stock dividend distributions were compared; and (5) The price performances of stock-split and stock-dividend securities of equivalent distribution size were compared. The nonparametric Kruskal-Wallis H Test was used to compare the monthly cumulative average residuals for each of these various groupings. These test results and their implications are presented in the following section.

Conclusions

Stock Splits and Stock Dividends

According to the statistical model developed in this paper, the occurrence of consistently positive residuals during the months prior to a firm's announcement of the intention to process a stock split or a stock dividend would indicate that the price of the security is affected by information attributable to the new distribution. In the present study, the average and cumulative average residuals of the securities studied showed that substantial price appreciation takes place up to the announcement month. The data also show that additional favorable price action occurs from the announcement month up to the actual new-distribution month. Of the total positive cumulative price change occurring from five months preceding the new-distribution month, 32 per cent occurs during the month preceding the month of the new distribution. Inasmuch as the announcement of a new distribution would generally occur in advance of this period, it may be possible to profit by buying after the announcement.

One explanation of these price changes utilizes the valuation model referred to in Chapter III, i.e.,

$$V_o = \int_0^{\infty} D_o e^{-x(k-g)} dx$$

where:

V_o = value of the stock at time zero,

D_o = current dividend,

g = growth rate for dividends, and

k = appropriate capitalization rate.

This model suggests that any positive change in the dividend growth rate (g) would lead to an increase in the price of the stock. Of the 122 new-distribution securities investigated in this paper, 111 (or 91 per cent) experienced increases in cash dividends within the study period. However, only 54 of the 122 control stocks (or 44 per cent) experienced cash dividend increases. From these results one may infer, as have Barker and Fama, et al., that the announcement of an impending stock split or stock dividend is a strong indication that the cash dividend will be increased. This expected increase in the cash dividend may be interpreted as an increase in the dividend growth rate, g. According to the model above, to the extent that stock splits and stock dividends imply increases in the growth of cash dividends, the price of the stock will also be increased.

The results of this study agree with the Barker and the Fama et al., conclusions that much of the change in price of new-distribution stocks may be attributed to information concerning cash dividends.[63]

Market Period Results

The Kruskal-Wallis H test shows significant difference exists among market periods in stock price behavior for new-distribution securities. The test results show that price changes of securities having new distributions are significantly different when grouped according to bull, bear and no-change market periods.

One explanation for the differences in price action among market periods is related to growth. For example, this study has shown that securities processing new-stock distributions during the bear-market period experienced the lowest positive cumulative price changes. Growth expectations for an individual firm over some extended period of time hinge in part upon a broad-based strength of economic activity. A single

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[63]Barker, Austin, "Effective Stock Splits," p. 101. Fama, et al., "The Adjustment of Stock Prices to New Information," p. 6.

firm or a few firms will find it difficult to maintain a strong growth posture while the majority of firms within an economy are suffering from declining activity. During a bear-market period, relatively weak existing and/or expected economic activity is usually witnessed; therefore, stocks would be suffering from low growth prospects. A new-stock distribution, implying growth, would therefore be interpreted with cautious optimism. Any change in the growth estimate for these stocks, although positive, would be rather small; positive price changes would also be small.

Similarly, this study has shown that cumulative price changes for securities processing new-stock distributions during the bull-market period were somewhat greater than price changes for new-stock distributions during the bear-market period. During a bull-market period, stock prices, together with sales, profits and cash flows, would be increasing; thus, the ability of the firm to pay dividends would also be increasing. Even without knowledge of a new distribution, growth expectations for many firms would be high. Therefore, if a firm processed a stock split or stock dividend during such a period, the effect on the growth estimate would not be great. The new distribution merely provides a confirmation to the high expected value already assigned to growth. Thus, the result of the new distribution is a minor adjustment in the growth estimate and a correspondingly minor positive price change.

Stocks processing new distributions during the no-change market period were characterized by the largest cumulative price changes. The reason may be that during a no-change market period, stock prices are moving in both upward and downward directions. However, the majority of stocks are not associated with extreme price changes in either direction for any extended time period. During a no-change market period investors are searching for some sign to indicate a trend in the direction of these price wanderings. The stock-split or stock-dividend distribution implies that management is confident of its ability to increase cash dividends, thereby presenting investors with a signal as to the direction of the stock's price movement. In addition, previously assigned growth prospects during no-change market periods are low, relative to bull-market periods. At the same time, the economic activity attending no-change market periods would be favorable for growth relative to bear-market periods. Consequently, when a split occurs during a no-change market period, the expected value for growth would be subjected to a major upward revision. This revision in turn would lead to a large increase in price relative to bull and bear-market periods.

Terminology Describing the Distribution

Research in financial literature has rarely distinguished stock splits from stock dividends. The Fama, *et al.*, study treated them as a homogeneous group.[64] A widely used finance textbook states, "From a practical standpoint there is very little difference between a stock dividend and a stock split."[65]

This study has shown that the price behavior of securities processing stock distributions described as stock "dividends" is significantly different from the price behavior of securities processing stock distributions described as stock "splits." Classification of the securities into either the stock-split or stock-dividend group was made on the basis of the terminology used by various investor services to describe the increase of outstanding shares. For example, if the description of the new distribution contained the phrase "two-for-one," it was classified as a split. If, on the other hand, the description of the new distribution included a phrase such as "100 per cent distribution," it was classified as a stock dividend.

The results of the Kruskal-Wallis H test show that the terminology used to describe the new distribution did indeed affect the price of the security. Specifically, the positive cumulative price changes of stock "dividends" are greater than those of stock "splits," perhaps because investors

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[64]Fama, et al., "The Adjustment of Stock Prices to New Information," p. 3.

[65]Eugene Brigham and F. Weston, Essential of Managerial Finance, (New York: Holt, Rinehart, and Winston, 1968), p. 377.

interpret the term "stock dividend" to mean a transfer of assets, i.e., cash dividends. Whereas new distributions in general may provide information concerning some future uncertain change in cash dividends, a stock dividend may be regarded as equivalent to a certain cash receipt. Therefore, the price action attending securities with cash receipts considered to be certain would be more favorable than for securities promising uncertain future cash receipts.

Size of Distribution

The American Institute of Certified Public Accountants and the New York Stock Exchange assume that the dilution of assets, earnings, etc., resulting from large stock distributions is recognized by the market, and thus they assume that the price is adjusted accordingly. At the same time, any dilution resulting from small distributions by stock-split and stock-dividend methods is thought to go relatively unnoticed in the market place. Therefore, different accounting treatments are recommended for large and for small stock distributions. If this assumed relationship exists, the price behavior of securities with large distributions would be subject to less distortion than the price behavior of stocks with small distributions.

This hypothesis is supported by the sample test results. The Kruskal-Wallis H tests shows that distributions (both stock splits and stock dividends) of less than 100 per cent are associated with higher cumulative price changes than those of 100 per cent or greater. In addition, those distributions equal to 100 per cent and two-for-one tended to generate relatively low positive cumulative price action.

One explanation for the relatively unfavorable price changes of 100 per cent distributions may be that investors have a better understanding of distributions that double the number of shares than of distributions of any other size. Two-for-one stock splits and 100 per cent stock dividends are the distribution sizes most widely used for example purposes in textbooks and general finance writing. This distribution size also appears more frequently in practice than any other distribution size. Because this distribution size is so common, investor expectations would probably center on a doubling of the shares. This doubling of the shares is understood to be a recapitalization process, not a distribution of assets. A distribution resulting in less than or greater than doubling the outstanding shares is different from the expected recapitalization. Those distributions resulting in less than double the outstanding shares may be regarded as a form of dividend and valued as such. Those distributions which more than double the number of shares may be considered a recapitalization plus a dividend. For example, a 150 per cent stock dividend may be regarded as a recapitalization plus a 50 per cent dividend, resulting in greater price action than would result for a recapitalization alone.

Implications for Previous and Future Studies

The purpose of this study was to determine whether increasing the number of shares by stock splits and stock dividends affected monthly price changes and whether the market period, size of the distribution and terminology attending the distribution could explain some of the difference in price action. The study concluded that securities that split or process large stock dividends do have price action that differs from securities not associated with new distributions. Further, the price performance of new-distribution securities varies as to type of market period, size of distribution, and terminology used to describe the new distribution.

The conclusions of this study agree with those of Fama, et al., and Barker, in that all emphasize the importance of cash dividends as an information medium for valuing stocks that declare new distributions. However, this paper has advanced a more refined point. The variables analyzed --- market periods, size of distribution, and nature of the terminology describing the distribution --- contain additional information which the investing market utilizes in assessing growth prospects for new-distribution stock.

This dissertation has revealed several areas in which additional research is needed to more fully understand the effects of new distributions on security prices. For example, it should be emphasized that the conclusions of this study are valid so long as the empirical form of the variables in the statistical model properly reflect those of the conceptual model. Other forms for expressing the variables, such as dividend payout ratios, price-earnings ratios and the inclusion of other variables to account for financial and operating leverage, risk, etc., might provide more insight. Expected and lagged data may also explain more of the variance. Other forms of stock distribution, such as rights offerings and the exercise of warrants and conversion privileges are similar to stock splits and stock dividends in that they increase the number of shares but do not increase the assets proportionately. This study has shown that positive price changes are associated with stock-split and stock-dividend distributions. Thus, an investigation of the price behavior of securities associated with these other forms of stock distribution may be desirable.

Although this study has dealt with the price behavior of securities from the view of individual investors and financial managers, it also has implications from a macro-economic viewpoint. The economic system of the United States is responsible for the yearly production of approximately a trillion dollars worth of goods and services. This high production level involves the comprehension of an extensive and complicated system of financial assets, institutions and markets. Information concerning the behavior of these financial assets and their markets contributes to a clearer understanding of the complexities of this nation's economy.

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APPENDIX

APPENDIX I

SPLIT AND STOCK DIVIDEND SAMPLE

1. Admiral Corporation
2. Allied Stores
3. American Cyanamid
4. American Seating
5. Ashland Oil and Refining
6. Bendix Corporation
7. Braniff Airways
8. Burndy Corporation
9. Carpenter Steel
10. Cincinnati Milling Machine
11. Consolidated Freightways
12. Continental Can
13. Crompton Knowles
14. Dennison Manufacturing
15. Georgia Pacific
16. Grant (W. T.)
17. Hammermill Paper
18. Holly Sugar
19. Household Finance
20. International Business Machines
21. International Minerals and Chemicals
22. Kennecott Copper
23. Kresge Company
24. Kroehler Manufacturing
25. Lucky Stores
26. Macke Company
27. Michigan Seamless Tube
28. Midland Ross Company
29. Monarch Machine Tool
30. Phillip Morris
31. Reliance Electric
32. Scott Foresman Company
33. Skelly Oil
34. Square D. Company
35. Sun Oil Company
36. United Air Lines
37. Zenith Radio
38. Caldor Incorporated
39. Campbell Machine Incorporated
40. Commercial Metals
41. Mount Vernon Mills
42. Baxter Laboratories
43. Chromalloy American Corporation
44. Continental Cooper and Steel
45. Columbia Pictures
46. Delta Airlines

47. Englehard Minerals
48. Federal Paper Board
49. International Salt
50. Kirby Industries
51. Loehman's Incorporated
52. Maryland Cup
53. National Presto Industries
54. Masco Corporation
55. O'Sullivan Rubber
56. Perkin Elmer
57. Quaker State Oil
58. Seligman and Latz
59. Stone and Webster
60. United States Freight
61. American Hospital Supply
62. Bliss and Laughlin
63. Buffalo Forge
64. Crowell Collier
65. Eagle Pitcher Industries
66. Fedder's Corporation
67. Famous Artist's Schools
68. Hormel
69. Interco Incorporated
70. Kresge (S. S.)
71. Leasco Data Processing
72. M.C.A. Corporation
73. Milton Bradley
74. Norris Industries
75. Pennsylvania Engineering and Manufacturing
76. Phillips Industries
77. Product Research and Chemical
78. San Diego Gas and Electric
79. Swingline Incorporated
80. United States Radium
81. Virginia Electric Power
82. Woods Corporation
83. Superscope
84. American Crystal Sugar
85. American Telephone and Telegraph
86. Armstrong Cork
87. Bigelow-Sanford
88. Carter Products
89. Cerro Corporation
90. Columbia Broadcasting System
91. Control Data
92. Delta Airlines (twice)
93. Segrams Distillers
94. Dr. Pepper
95. Edison Brothers Stores
96. Electronic Associates
97. Falstaff
98. Georgia Pacific

99. Harris Intertype
100. Ingersoll Rand
101. International Business Machines (twice)
102. Interstate Department Stores
103. Leesona Corporation
104. Macy (R. H.)
105. May Department Stores
106. McDonald Aircraft
107. New Jersey Zinc
108. Pan American World Airways
109. Piper Aircraft
110. Polaroid Corporation
111. Reigel Paper
112. Royal Crown
113. Safeway Stores
114. Standard Oil Indiana
115. Sunbeam Corporation
116. United States Plywood
117. Western Air Lines
118. Whitco Chemical
119. Youngstown Sheet and Tube
120. Transamerica
121. Sherwin-Williams
122. Greyhound Corporation

APPENDIX II

CONTROL STOCK SAMPLE

1. American Smelting
2. American Radiator
3. American Sugar
4. American Telephone
5. American Tobacco
6. Amtek
7. Ampex
8. Amsted Industries
9. Anaconda Company
10. Anchor Hocking
11. Apco Oil
12. Arizona Public Service
13. Arlans Department Stores
14. Armco Steel
15. Armstrong Cork
16. Armstrong Rubber
17. Associated Dry Goods
18. Atlantic City Electric
19. Atlantic Richfield
20. Atlas Chemical Company
21. Babcock-Wilcox Company
22. Baker Oil Tools
23. Baltimore Gas and Electric
24. Bath Industries
25. Donnelley RR Sons
26. Beckman Instruments
27. Belco Corporation
28. Beneficial Finance
29. Bethlehem Steel
30. Black and Decker
31. Bobbie Brooks
32. Bond Stores
33. Book of the Month
34. Borden Incorporated
35. Bormans Incorporated
36. Boston Edison
37. Broadway Hale Stores
38. Dana Corporation
39. Deere Corporation
40. Detroit Edison
41. Dr. Pepper Company
42. Brooklyn Union Gas
43. Burndy Corporation
44. Brunswick Corporation
45. Budd Company
46. Burlington Industries

47. Burroughs Corporation
48. C.I.T. Finance
49. C.P.C. International
50. C.T.S. Corporation
51. Campbell Soup
52. Canal Randolph Corporation
53. Carolina Power
54. Carpenter Tech
55. Carter Wallace
56. Case J.I.
57. Caterpillar Tractor
58. Celanese Corporation
59. Central Hudson Gas and Electric
60. Central Illinois Public Service
61. Central Maine Power
62. Central Southwest Corporation
63. Central Soya Company
64. Certain-Teed Products
65. Chemtron Corporation
66. Chesebrough Ponds
67. Chicago Pneumatic Tool
68. Chrysler Corporation
69. Cincinnati Gas and Electric
70. Cincinnati Milling
71. Cities Service
72. Clark Equipment
73. Cleveland Electric
74. Cluett Peabody
75. Coca-Cola
76. Colgate Palmolive
77. Collins Radio
78. Consol Edison
79. Consol Freight
80. Cox Broadcasting
81. Creole Petroleum
82. Crown Cork and Seal
83. Crown Zellerbach
84. A.C.F. Industries
85. Acme Markets
86. Disney (Walt)
87. Addressograph
88. Admiral
89. Air Products
90. Air Reduction
91. Alabama Gas
92. Dow Chemical
93. Allegheny Ludlum
94. Allied Chemical
95. Allied Mills
96. Allied Stores
97. Allied Supermarkets
98. Allis-Chalmers

99. Alcan
100. Alcoa
101. Amerada
102. American Airlines
103. American Bakeries
104. Duquesne Light
105. American Brake Shoe
106. American Broadcasting
107. American Can
108. American Cement
109. American Chain Cable
110. American Cynamid
111. American Distilling
112. American Electric Power
113. American Enka
114. American Home Products
115. American Hospital Supply
116. American Machine Foundry
117. American Metal Climax
118. American Motors
119. American Natural Gas
120. American Photo Copy
121. American Potash
122. American Seating