THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

PREDICTING COMMON STOCK RETURNS:

A MACROECONOMIC, SIMULTANEOUS-EQUATION APPROACH

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

DOCTOR OF PHILOSOPHY

BY

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Norman, Oklahoma

1974

PREDICTING COMMON STOCK RETURNS:

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TABLE OF CONTENTS

		Page
LIST OF TABLES		iv
Chapter		
I.	INTRODUCTION	1
II.	VALUATION PROCEDURES	9
III.	MODEL AND METHODOLOGY	35
IV.	EMPIRICAL EVALUATION	56
V.	SUMMARY AND CONCLUSIONS	93
BIBLIOGRAPHY		105

LIST OF TABLES

Table		Page
1	Summary Goodness-of-Fit Statistics: Quarterly, 1961-2 through 1970-4; Specification Sample	62
2	Summary Goodness-of-Fit Statistics: Quarterly, 1961-2 through 1970-4; Test Sample	62
3	Comparative Goodness-of-Fit Statistics: Normalized Versus Unnormalized Earnings Data; Quarterly, 1961-2 through 1970-4; Structural Equations Only	65
4	Actual (Normalized) Versus Predicted Values for E, E/P, and D	66
5	Predictive Comparisons: Combined One and Two Quarter Predictions	71
6	Predictive Comparisons: One Quarter Predictions	72
7	Measures of Prediction Error: Based on Predictions for 1971-1 and 1971-2	75
8	Regression Results: Earnings	77
9	Regression Results: Earnings-Price Ratio	78
10	Regression Results: Dividends	81
11	Prediction of Peak and Trough Turning Points	84
12	Predictive Comparisons: One and Two Quarter Predictions	89
13	Predictive Comparisons: One Quarter Predictions	91
14	Peak Versus Trough Predictions: One Quarter Predictions	92

CHAPTER I

INTRODUCTION

For more than a century the possibility of investing in common stocks has been an important decision variable for the investing public. However, investors have not always purchased common stocks with the same ultimate goal in mind. Indeed, prior to the mid-1920's, common stocks were regarded as speculative securities. In more recent times investor attitudes have changed and common stocks are considered to be viable investment alternatives.

The change in attitude toward common stocks was the result of two rather independent events. First, the world-wide boom in economic activity following World War I made the excessive returns to common stock in the form of dividends and price appreciation readily observable to the investing public. Common stocks were purchased on the basis of the past performance of the corporation. Second, a historic study by Edgar L. Smith revealed the consistent performance of common stocks as investment securities to the investment conscious private citizen and institutional investor.[1]

Prior to these two events, corporate bonds were considered superior to common stocks as investment securities. A bond was treated as a sound

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[1] Edgar Lawrence Smith, Common Stocks as Long-Term Investments, (New York: The MacMillan Company, 1926).

investment only if the expected prosperity of the corporation would allow payment of the required interest without default. However, the ability of the firm to continually cover all fixed charges implied a profitable economic operation. Smith reasoned that this profit may be passed along to the stockholders in the form of dividends, or reinvested to allow growth in future earnings and dividends. Therefore, if the bonds of a corporation were considered to be a sound investment, the common stock should also be financially secure.

Smith tested the hypothesis by comparing well diversified portfolios of common stock with bond portfolios of equal size over various test periods from 1866 to 1922. Only one bond portfolio outperformed a common stock portfolio. Furthermore, the returns to common stock portfolios were superior to the returns of bond portfolios in both periods of dollar appreciation and dollar depreciation. Therefore, Smith concluded that common stocks were better investment securities than corporate bonds. Although criticisms of Smith's study appeared,[2] further studies supported his results.[3]

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[2] Abraham Tonkin, "The Fixed Investment Trust," Barron's, May, 1930, pp. 22-28.

[3] J.S. Amberg, "Testing the Theory of 'Stocks for Long Term Investment' in a Bear Market," The Magazine of Wall Street, February, 1931.

Gilbert Harold, "A Reconsideration of the Common Stock Theory," Journal of Business, VII (January, 1934), pp. 42-59.

James Roy Jackson, "Common and Preferred Stocks as Investments," Journal of Business, I (July, 1928), pp. 294-323.

Dwight C. Rose, A Scientific Approach to Investment Management (New York: Harper and Brothers, 1928).

Kenneth S. Van Strum, "Investing in Purchasing Power," Barron's, 1926.

The change in emphasis from bonds to common stocks as superior investment securities raised a question that remains unanswered even today. What determines the market value of common stocks? More specifically, what variables do investors deem important when estimating the future value of common stocks? These questions have been discussed continuously over the last fifty years.

As a result of the 1926 study, Smith postulated that reinvesting corporate earnings affects future earnings according to the compound interest principle. In a study released two years later, Rose concluded that the "reinvestment of excess earnings was responsible for most of the growth in stock values."[4] While agreeing with Rose and Smith, Bosland warned that earnings should not be retained unless such retention would increase the earning power of the firm.[5] That is, increased future earnings are directly dependent upon profitable employment of the corporation's assets.

The argument against retained earnings as the prime determinant of corporate valuation was best proposed by Graham and Dodd shortly after the stock market crash in 1929.[6] Because Graham and Dodd felt that investment and dependable income were closely related, the price paid for a share of

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[4] Rose, <u>Investment Management</u>, p. 177.

[5] Chelcie C. Bosland, <u>The Common Stock Theory of Investment</u> (New York: The Ronald Press Company, 1937).

[6] Benjamin Graham and David L. Dodd, <u>Security Analysis</u> (2nd Ed.; New York: McGraw-Hill Book Co., Inc., 1940).

common stock should be determined primarily by the amount of dividends received from the stock. Furthermore, the dividends should be paid regularly and should increase with time. Graham and Dodd estimated that a dollar of earnings paid out in dividends was worth four times as much as a dollar of earnings retained as surplus.

The disagreement over the relative importance of retained earnings versus dividends has proven to be only the beginning in the search for variables that may aid in the valuation of common stock. Other variables that have been considered important are the size of the corporation, the debt-equity ratio, the growth in dividends and/or earnings, the variation in earnings, etc.

Nearly all equity valuation models have included some variation of micro-oriented firm variables. However, very few models have explicitly recognized the role of macroeconomic variables. The early work of Tinbergan recognized the importance of the long-run interest rate,[7] while Rose considered commodity prices and various interest rates.[8] The assumption implicit in recognizing only firm financial variables is that the value of the firm is either unaffected by occurrences within the immediate industry, national economy, and/or international economy, or the affects of these macro variables are absorbed within the firm variables. Rather than make an assumption

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[7]Jan Tinbergan, "The Dynamics of Share-Price Formation," Review of Economics and Statistics, XXI (November, 1939), pp. 153-60.

[8]Rose, Investment Management, pp. 175-77.

of this magnitude, a more desirable approach would be to explicitly consider relevant macro-economic variables.

Initial stock valuation models were characterized by the discounting of either a stream of earnings or a stream of dividends over a given horizon in search of a present value figure. In the late 1950's, emphasis shifted from present value models to single-equation regression models that more easily allowed for the treatment of additional variables. Such single-equation models require that a set of presumably independent, exogenous explanatory variables be specified a priori. These explanatory variables are then adjusted, manipulated, and transformed until a statistically significant proportion of the dependent variable is explained. The dependent variable is usually defined as a security value or transformation thereof. Results of tests on such single-equation models have included parameter instability, inconsistent signs, and the lack of statistical significance among many of the micro variables. These results are not unexpected in that many of the variables involved in such models are not exogenous at all but most likely are jointly determined as parts of some simultaneous system of performance. Therefore, the results produced by models that reflect the interdependencies among variables should be more useful in equity valuation than the results of the single equation approaches utilized in the past.

Purpose

The foregoing comments suggest disagreement as to what constitutes the major elements in common stock valuation. Furthermore, the specifications of past equity valuation models do not allow for interaction among the independent variables. If, in fact, many aspects of share price performance are jointly determined, explanation of equity valuation is only possible with a simultaneous-equation model. This study will attempt to develop and evaluate a simultaneous-equation valuation model for predicting the return to a share of common stock. A system that reflects the interdependencies that exist among the major determinants of equity value, both micro- and macroeconomic, should be superior to a single equation approach to equity valuation.

Scope

One of the goals of this study is to produce a valuation model which is applicable to individual firms. Therefore, specification is achieved through the use of time series data of market or macroeconomic and firm or microeconomic variables obtained over the period 1960 through 1970. The use of quarterly observations provides at least thirty-five degrees-of-freedom for specifications of the model.

The model is originally specified on each of a sample of five industrial stocks obtained from the Dow-Jones Industrial Index. After specification is complete, the model is tested over five additional firms chosen on the basis of the same criteria used in the selection of the sample firms. The stocks used in both the specification and test samples are selected so as to minimize the number of adjustments necessary as a result of stock splits, stock dividends, or similar occurrences.

The model is evaluated in several ways. First, comparisons between the estimates of the endogenous variables and the actual values are presented on the basis of goodness-of-fit or R^2 values. Second, the predictive ability of the model is evaluated by predicting the values of the endogenous variables beyond the specification data. These predictions are compared with the actual values and other predictions generated from naive models. The Henri Theil Inequality Coefficient is also calculated to analyze the predictive power of the stochastic equations. Third, the stability of the model is evaluated by comparing estimated parameter signs and magnitudes from two different subperiods of time within the initial specification time interval. In addition, predictions based on both reestimations are compared and evaluated.

Organization of Study

Chapter II presents a review of the literature pertinent to the choice of the determinants of equity valuation. The methodologies and conclusions of various studies are presented.

Chapter III develops the theoretical and statistical model used to analyze the determinants of equity valuation and predict the returns to common stock. In addition, the various statistical techniques utilized in the investigation are explained.

Chapter IV explains the methods used to gather and interpret the data. The exact specifications of the model and the empirical results of testing the model are also presented.

Chapter V summarizes the study and develops the implications of the test results and simultaneous-equation model.

CHAPTER II

VALUATION PROCEDURES

Investments of all types have long been valuable because of the desirable properties provided to the investor. If these investments have aesthetic qualities, the true value may be difficult to measure. However, because the desirable properties of financial assets are monetary in nature, the value of financial investments can be measured in some standard unit of exchange, e.g., dollars. But, this characteristic does not mean that the valuation process is exact. Considerable debate concerning what actually affects the value of financial securities has occurred over the years. This chapter will present a survey of various theories and techniques of equity valuation that have been used over the years.

Theory of Valuation

Early Years

The origin of common stock is traceable to the instruments used to finance trade in the Middle Ages. However, early trading was done without knowledge of underlying real variables that might affect equity prices. The lack of any implicit valuation model or economic relationship led to several extreme market disturbances during the eighteenth and nineteenth centuries. Although formal models as known today were not immediately developed, procedures for the professional evaluation of common stock gradually evolved.

In the years prior to World War I, the analysis of common stocks for investment purposes was primarily concerned with finding weaknesses in the corporate structure and operation. If no weaknesses in the corporate environment could be found and past performance was acceptable, a stock was usually considered a good investment prospect. Past performance was evaluated by comparing average earnings with price. Thus, the stability and trend in past earnings were considered to be the major determinants of stock value.

Following World War I, the emphasis on common stock valuation switched from the past to future. The past was important only to the extent of indicating possible future earnings and dividends. The future earnings power of stock was considered good if earnings had increased consistently in the past, i.e., the stock should be purchased regardless of the price. Because no attempt was made to relate corporate activity to the overall economic activity of the country, the "purchase regardless of price" philosophy led to the stock market crash of 1929.

Although common stocks were valued in terms of future earnings expectations or anticipations, the market disaster in 1929 indicated that the earnings trend must eventually flatten out. Thus, Graham and Dodd put forth four guidelines for the valuation of common stock.[9] First, dividends should

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[9] Benjamin Graham and David L. Dodd, Security Analysis (2nd Ed.; New York: McGraw-Hill Book Co., Inc., 1940), pp. 443–487.

be paid regularly and should increase with time. A dollar of earnings paid out in dividends was considered to be worth four times as much as a dollar of earnings retained as surplus.

Second, because calculation of the earning power of the stock combined past earnings with expectations of future earnings, the trend of past earnings was to be compared with relevant qualitative data. This qualitative data included the type of industry, the firm's relative position within the industry, the nature of the overall stock market, etc. Graham and Dodd contended that a price-earnings ratio greater than twenty indicated a speculative security. On the other hand, a price less than ten times earnings signified either an undervalued stock or erroneous financial accounting.

Third, Graham and Dodd warned investors about attaching too much economic value to the assets of a corporation. The value of fixed assets frequently bore no relationship to the actual cost or replacement cost. Furthermore, Graham and Dodd quickly indicated the possible extreme variance between book values and liquidation values.

The final guideline put forth by Graham and Dodd suggests that industrial common stock is a good investment if (1) current assets minus inventories are at least equal to current liabilities, and (2) there are at least two dollars of current assets for each one dollar of current liabilities. The investor would naturally favor companies that exceed these minimum quantitative requirements.

Although no specific evidence is available concerning the use of Graham and Dodd's guidelines, at least two guidelines seem to indicate the influence of their work in the valuation decisions of the Securities and Exchange Commission. According to a study by Chelcie C. Bosland,[10] the Commission has considered earning power and earnings trend as the proper basis for value determination and has treated asset values with indifference. Furthermore, the regulatory body has rarely considered size, cash position, capital structure, etc. in determining divestitures between corporations. These guidelines are consistent with the Graham and Dodd recommendations.

Present Value Theory

As the emphasis in common stock valuation changed from past events to future expectations, investors realized that common stocks were valuable only because of future cash flows. The possible cash flows could come from either of two components: (1) the periodic payments of dividends or interest; and (2) the price of the asset when sold. Investors realized that future payments are not as valuable as current receipts. Thus, to determine the present value of an asset in a world of certainty, all future cash flows must be discounted to reflect the time value of money. Because the future cash flows of common stock are not completely determined in an uncertain world, the discount rate used to determine the present value of these uncertain cash flows

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[10] Chelcie C. Bosland, Valuation Theories and Decisions of the Securities and Exchange Commission (New York: Simmons-Boardman Publishing Corporation, 1964), pp. 84-89.

will be greater than the discount rate in a world of certainty. The difference in size between the certainty discount rate and the uncertain discount rate reflects the degree of uncertainty or risk regarding the future cash flows as perceived by the investor.

Although the present value method of common stock valuation has been readily accepted, controversies concerning the application of the methodology have arisen. The first source of controversy is whether the future stream of dividends to the stockholder or the future stream of earnings to the corporation is the proper stream of cash flows to discount. The second disagreement concerns the appropriate rate for discounting future cash flows and the correct procedure for estimating the degree of uncertainty involved. These two controversies will be discussed in the following two sections respectively.

Cash Flows: Dividends versus Earnings

Although a British actuary named Ralph Todhunter is given credit as the first to suggest the present value method in 1882,[11] S. Eliott Guild was the first to apply the present value method to common stock in 1930.[12] Guild contended that a share of common stock could be profitably held only if the purchase price was less than the present value of all future cash flows.

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[11] Robert M. Soldofsky, "A Note on the History of Bond Tables and Stock Valuation Models," Journal of Finance, XXI (March, 1936), p. 104.

[12] S. Eliott Guild, "Foresight, Hindsight, and Foresight," The Analysts Journal, XII (August, 1956), p. 55.

Although the methodology of Guild was revised in 1935 by Kenneth E. Boulding,[13] the concept of present value was not readily accepted until the classic work of John Burr Williams in 1938.[14] Williams held that common stocks were purchased as an investment (versus speculation) with dividends as the only return. Therefore, discounting the stream of expected future dividends would yield the present value of stock. In specific terms, the intrinsic value of a share of stock is found by:

$$V_o = \frac{D_1}{(1+i)} + \frac{D_2}{(1+i)^2} + \ldots \frac{D_N}{(1+i)^N} \qquad (2\text{-}1)$$

where V_o is the present value of the share, D_1 is the dividend in the first period, D_2 is the dividend for period two, and so forth, and i is the appropriate discount rate. Although Williams assumes that the investment nature of common stock precludes the consideration of capital gains, changes in market value may be considered by discounting the stream of dividends plus money received when the asset is sold.

Further support for the dividend hypothesis is generated by Gordon.[15] By assuming a constant rate of growth in dividends (or earnings)[16] per share,

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[13] Kenneth E. Boulding, "The Theory of a Single Investment," The Quarterly Journal of Economics, IL (May, 1935), pp. 475-494.

[14] John Burr Williams, The Theory of Investment Value (Cambridge, Mass.: Harvard University Press, 1938). Reprinted by North-Holland Publishing Company, Amsterdam in 1964. Especially Chapter V, pp. 55-75.

[15] Myron J. Gordon, "Dividends, Earnings, and Stock Prices," Review of Economics and Statistics, XXXXI (May, 1959), pp. 96-105.

[16] Total dividends will grow at the same rate as total earnings. However, dividends per share will grow at the same rate as earnings per share only if all investment is financed internally.

Gordon defined the present value of a share of stock as follows:

$$V_o = \frac{D_o(1+g)^1}{(1+i)^1} + \frac{D_o(1+g)^2}{(1+i)^2} + \ldots \frac{D_o(1+g)^N}{(1+i)^N} \qquad (2\text{-}2)$$

where g is the constant growth of dividends per share and the other notation is as defined in equation (2-1). By assuming that dividends are paid continuously to infinity, equation (2-2) can be rewritten as:

$$V_o = \frac{D}{i-g} \qquad (2\text{-}3)$$

As indicated by Durand, V_o will be a finite value only if the dividends are discounted at a rate greater than the growth rate.[17] This assumption is plausible and will be discussed in greater detail in a later section.

In further studies, Gordon concluded that the dividend-payout ratio was a prime determinant of price-earnings ratios.[18] A study by James Walter further supported Gordon and the dividend hypothesis of common stock valuation.[19]

Because the stream of future dividends is derived from the stream of future earnings, some scholars expressed concern regarding the relative value of future earnings. Upon purchasing a share of common stock the investor has ownership rights to the earnings per share of stock regardless of

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[17] David Durand, "Growth Stocks and the St. Petersbury Paradox," Journal of Finance, XII (September, 1957), pp. 348-363.

[18] Myron Gordon, Investment, Financing and Valuation of the Corporation (Homewood, Illinois: Richard D. Irwin, Inc., 1962), pp. 87-156.

[19] James Walter, "Dividend Policies and Common Stock Prices," Journal of Finance, XI (March, 1956), pp. 29-41.

whether the earnings are distributed as dividends or retained to generate an increase in the share's value. Thus, earnings should be the prime determinant of a common stock's value. This view is discussed by Lutz and Lutz.[20]

The consideration of the earnings hypothesis received additional support in the mid-1950's as the growth stock era commenced. As was the case with dividends described above, the discounted value of earnings growing at a constant rate to infinity is given by the following:

$$V_o = \frac{E}{i-g} \tag{2-4}$$

where E is earnings per share. Again, the discounted value is finite only if i is greater than g. This condition is plausible for two reasons. First, Gordon points out that i can be expected to increase over time as the uncertainty of future earnings increases. Second, without exception, high growth rates have not remained constant indefinitely.

The effect of growth in earnings on the value of a share of common stock is evaluated in a somewhat different manner by Holt.[21] By determining the length of time that current growth rates must continue to justify the current price-earnings ratio, Holt indirectly lends support to the earnings hypothesis of stock valuation. Further support of the earnings hypothesis is

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[20] Frederick Lutz and Vera Lutz, <u>The Theory of Investment of the Firm</u> (Princeton University Press, 1951), p. 155.

[21] Charles C. Holt, "The Influence of Growth Duration on Share Prices," <u>Journal of Finance</u>, XVII (September, 1962), pp. 465-475.

generated pragmatically by considering that some firms have enjoyed very high price-earnings ratios without paying any dividends to the stockholder.

The dividend versus earnings controversy has not continued without an attempt at resolution. In a now famous article, Miller and Modigliani demonstrate mathematically that the valuation of common stock is equivalent for either the earnings hypothesis or the dividend hypothesis.[22] The reconciliation is dependent upon an explicit statement of the capital expenditure program. Given the capital expenditure program, Miller and Modigliani show that share values are "determined solely by 'real' considerations,"[23] i.e., the earning power of the firm's assets and the given investment policy. Thus, the manner of earnings distribution is irrelevant.[24]

The Miller and Modigliani position has not been accepted without criticism. Much of the criticism has been directed toward the unrealistic,

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[22] Merton H. Miller and Franco Modigliani, "Dividend Policy, Growth and the Valuation of Shares," Journal of Business, XXXIV (October, 1961), pp. 411-433.

[23] Ibid., p. 414.

[24] Consider a debt free firm where dividends equal that portion of earnings not retained ($D = (1-b)E$) and where the rate of return on new investment (r) is equal to the firm's discount rate (i). Thus, the growth rate of the firm equals br. Equation (2-3) may now be written as $V_o = \frac{D}{i-g} = \frac{(1-b)E}{i-br}$. If $r = i$, then $V_o = \frac{(1-b)E}{i(1-b)} = E/i$; proof that capitalizing dividends is equal to capitalizing earnings when $i = r$. Thus, the dividend policy is irrelevant. MM came to the same conclusion in the more general case of a firm with external financing and $i \neq r$.

rational and perfect information world that Miller and Modigliani assume. For instance, because of the risk aversion of investors, Gordon asserts that a dollar paid out in dividends is considered more valuable by the market than a dollar retained for reinvestment.[25] Miller and Modigliani counter that an investor can achieve the same current consumption by selling a dollar's worth of stock. Although other challenges to the position of Miller and Modigliani have occurred, few contrary positions have been substantiated.

Appropriate Discount Rate

Whether supporting the earnings hypothesis or dividend hypothesis, most investors agree that the present value method is the most appropriate means of determining the intrinsic value of common stock. This method requires that all future cash flows be discounted to the current value. Theoretically, the appropriate discount rate is the opportunity cost of making the investment. In a certain world, this opportunity cost is completely market determined.

As measured in the real, uncertain world, the discount rate is composed of two elements. First, the discount rate measures the opportunity cost of the most certain, riskfree assets. Second, because most investments are not riskfree, the discount rate must consider the degree of uncertainty surrounding future cash flows. The total, real-world discount rate may not be the same for two securities chosen at random or for two different

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[25] Myron Gordon, "The Savings, Investment, and Valuation of a Corporation," Review of Economics and Statistics, XXXXIV (February, 1962), pp. 37-51.

investors considering the same security. Thus, empirical studies have attempted to estimate the degree of uncertainty or risk involved in security investment. The results and implications of these studies are discussed in the next section.

Stock Valuation Models

As stated above, the present value theory of common stock valuation has been readily accepted. Specifically, the stock value is the present value of a stream of dividends or earnings growing at a constant rate. However, several problems arise when this method is put to practical use. Among the problems are determining the future dividend or earnings stream, determining the amount and appropriate horizon for the growth rate, and selecting the proper discount rate. Thus, most empirical studies have attempted to determine the effects on a share's value for given changes in the above mentioned and related variables. The results of these studies are now presented in the following format: (1) the transition from theory to empirical application; (2) a discussion of the variables considered; and (3) an analysis of the methods and results of specific stock valuation models.

From Theory to Empirical Tests

Most empirical stock valuation models have utilized some form of multiple regression analysis. The rationale for the transition from the present value model discussed above to a regression model is perhaps best demonstrated by Malkiel and Cragg.[26] Specifically, the present value dividend equation[27] may be stated as follows:

$$P = \sum_{i=1}^{\infty} D \frac{(1+g)^i}{(1+r)^i} \qquad (2\text{-}5)$$

provided that $g < r$. In this equation, P is the ex dividend price per share, D is the annual dividend per share, g is the long-term growth rate, and r is the appropriate discount rate. Dividing both sides of the equation by earnings per share (E) and summing the infinite series gives an expression for the price-earnings multiple:

$$\frac{P}{E} = \frac{D}{E} \frac{(1+g)}{(r-g)} \qquad (2\text{-}6)$$

Therefore, the price-earnings ratio depends on the dividend-payout and the long-term growth rate.

Although Equation (2-6) is more precise than Equation (2-5), Malkiel and Cragg list the following drawbacks: (1) the model is inapplicable if dividends are not paid; (2) a finite value is possible only if r is greater than g; and (3) the growth rates must be projected indefinitely.[28] These difficulties

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[26] Burton G. Malkiel and John G. Cragg, "Expectations and the Structure of Share Prices," The American Economic Review, LX (September, 1970), pp. 601-17.

[27] Although the dividend and earnings formulation of present value models theoretically yield the same results, most empirical investigations have considered some variation of the dividend model. Therefore, because no theoretical difference between the models exists according to MM, the dividend formulation will be referred to here.

[28] Malkiel and Cragg, "Structure of Share Prices," p. 602.

are avoided by considering above-normal dividends and earnings growth for a finite horizon, followed by assuming a growth rate for the remainder of the time period similar to the growth rate of the economy. Although various writers have developed alternative approaches to consider the finite-horizon of above-normal growth rates, most models may be reduced to the following equation:

$$\frac{P}{E} = \sum_{i=1}^{\infty} \frac{D}{E} \frac{(1+g)^i}{(1+r)^i} + (Ms) \frac{(1+g)^N}{(1+r)^N} \qquad (2\text{-}7)$$

where (Ms) is the average current price-earnings ratio for the market as a whole.[29]

Although Equation (2-7) appears to be nonlinear, Malkiel and Cragg have found that Equation (2-7) could be approximated very closely for a time horizon of at least five years by the following equation:

$$\frac{P}{E} = A + Bg + C \frac{D}{E} \qquad (2\text{-}8)$$

The effects on the P/E ratio of growth in earnings or dividends and the dividend payout can, of course, be estimated in a statistical sense by linear regression techniques. Thus, Equation (2-8) provides empirical support for the theoretical valuation model given in Equation (2-7). More importantly, Equation (2-8) shows that statistical estimation procedures can be utilized to attempt to specify the proper determinants of share value.

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[29] *Ibid.*, p. 602.

Before discussing the various models that have made use of the regression approach to estimate the effects of various determinants on equity values, a brief discussion of some of the variables is presented.

Important Variables

Valuation models differ in the number and type of variables included. However, most models include variations of several common variables. The dependent variable is usually considered to be normalized price, most commonly the price-earnings ratio. The reason for normalizing price is to measure price relative to other performance aspects of the firm.

The price-earnings ratio is most commonly regressed on growth in earnings, dividend payout, and risk. Of these independent variables, the measurement of earnings is the most important and perhaps the most difficult. Because earnings represent the true earning power of the firm, investors desire the most accurate measurement possible. Among the most popular methods of earnings measurement are earnings for the most recent time interval and some concept of "normalized" earnings.

Although a study by Green and Segall concludes that past earnings are not beneficial in the prediction of future earnings,[30] Brown and Niederhoffer conclude that interim quarterly earnings are benefical in predicting annual

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[30]David Green, Jr. and Joel Segall, "The Predictive Power of First-Quarter Earnings Reports," Journal of Business, XXXX (January, 1967), pp. 44-55.

earnings.[31] Furthermore, Cragg and Malkiel found that the extrapolation of historical earnings trends was highly correlated with the projections of analysts in the prediction of future earnings growth.[32] Thus, the use of historical earnings is accepted when analyzing the future.

Reported earnings are usually normalized to reduce the effects of excessive seasonality and any accounting irregularities that may occur. Whitbeck and Kisor define normalized earnings as earnings that would occur in a normal or mid business-cycle year.[33] Again, the estimates of normalized earnings provided by investment analysts have not proved superior to normalization via a moving average of past earnings, or other mechanical extrapolations.

The effect of dividends on share values has been primarily measured by the dividend-payout ratio. As with the price-earnings ratio, the dividend-payout ratio most commonly includes some form of normalized earnings. As a direct measure of the importance of the dividend effect, Bower and Bower found that higher price-earnings ratios coincide with larger dividend payouts.[34]

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[31] Phillip Brown and Victor Niederhoffer, "The Predictive Content of Quarterly Earnings," Journal of Business, XXXXI (October, 1968), pp. 488-97.

[32] J. G. Cragg and Burton G. Malkiel, "The Consensus and Accuracy of Some Predictions of the Growth of Corporate Earnings," Journal of Finance, XXIII (March, 1968), pp. 67-84.

[33] Volkert S. Whitbeck and Manown Kisor, Jr., "A New Tool In Investment Decision-Making," Financial Analysts Journal, XIX (May-June, 1963), p. 56.

[34] Richard S. Bower and Dorothy H. Bower, "Risk and the Valuation of Common Stock," Journal of Political Economy, LXXVII (May-June, 1969), pp. 349-362.

A similar study by Friend and Puckett revealed a lower market valuation of retained earnings than of dividends.[35] This evidence supports the theoretical expectations of Graham and Dodd, Williams, and Gordon discussed above, namely that investors value dividends more highly than earnings retention. This result implies that dividend policy does matter.

Miller and Modigliani contend that price appreciation following dividend rate increases is due to the "information content" of the dividend rate change.[36] Lintner also agrees that an increase in dividends reflects management's expectations of continuing and increasing future earnings and profits.[37] However, in a recent study, Watts found the potential information content of dividends to be very small, i.e., dividends convey very little information not conveyed by previous and current earnings.[38]

Whereas present value theory uses the discount rate to indicate the degree of risk or uncertainty of future cash flows, regression models measure the effects of risk in several ways. The uncertainty of future cash flows is interpreted as the expected variability of the future cash flows.

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[35] Irwin Friend and Marshall Puckett, "Dividends and Stock Prices," American Economic Review, LIV (September, 1964), pp. 656-82.

[36] Merton H. Miller and Franco Modigliani, "Dividend Policy, Growth, and the Valuation of Shares," Journal of Business, XXXIV (October, 1961), pp. 411-431.

[37] John Lintner, "Distribution of Income of Corporations Among Dividends, Retained Earnings, and Taxes," American Economic Review, XXXXVI (May, 1956), pp. 97-113.

[38] Ross Watts, "The Information Content of Dividends," Journal of Business, XXXXVI (April, 1973), pp. 191-211.

By reasoning that past earnings variability will continue in the future, early studies considered the variability of historical earnings to be an implicit proxy for risk. The relationship between the variance of returns and the level of stock prices was extensively analyzed by Malkiel.[39] For a given change in the level of stock prices, Malkiel found that the maintenance of a consistent structure of share prices required the price changes for non-dividend growth stocks to be more than proportional to the price changes of non-growth stocks. Malkiel concluded that the price-earnings ratio should be negatively related to the variance of returns.

More recent investment theory contends that the risk of individual stocks is relative to movements in the market. Thus, as shown by Sharpe, risk is correctly estimated as the sensitivity of the security's return to the return of the market.[40] In a test of the comovement thesis, Malkiel and Cragg found a negative relationship between the index of conformance and price-earnings ratios.[41]

As stated above, variables measuring dividends, earnings, and risk are most commonly included among the independent variables. The use of these and other variables in the valuation models is discussed below.

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[39] Burton G. Malkiel, "Equity Yields, Growth and the Structure of Share Prices," American Economic Review, LIII (December, 1963), pp. 1004-1031.

[40] William F. Sharpe, Portfolio Theory and Capital Markets (New York, N.Y.: McGraw-Hill Book Co., 1970), especially Chapter 3.

[41] Malkiel and Cragg, "Expectations and Structure," pp. 607-613.

Single Equation Models

Most prominent stock valuation models have been single-equation, multiple regression models. Although most of these models attempt to estimate the effects of several independent variables on equity value, the exact specification and results have not been consistent between models. Thus, several models and studies are now discussed.

Durand Study

One of the first statistical studies concerning stock prices was that of David Durand.[42] Durand was searching for the rate of return necessary to maintain a price-net worth ratio of at least 100 per cent. The dividend payout ratio was included in the equation as an explanatory variable and was assumed to be inversely related to the rate of return. Additional variables that were tested included the following: (1) total equity capital as a measure of size; (2) ratio of risk assets to capital; (3) ratio of current dividend rate to average past dividend rates; (4) average annual growth in earnings; and (5) stability of earnings as measured by the standard deviation of earnings about the trend line. These variables performed poorly and were not considered significant determinants of common stock prices. Upon testing over several samples, Durand found the parameter estimates to be unstable and sample sensitive.

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[42] David Durand, "Bank Stock Prices and the Bank Capital Problem," (New York: National Bureau of Economic Research, occasional paper 54, 1957).

David Durand, "Bank Stock Prices and the Analysis of Covariance," Econometrica, XXIII (January, 1955), pp. 30-45.

Benishay Study

An attempt to empirically examine the determinants of differences in rates of return on corporate equities was made by Haskel Benishay.[43] Benishay hypothesized that the rate of return is functionally related to the following variables: (1) the growth in earnings; (2) the growth in equity; (3) the dividend payout ratio; (4) the debt-equity ratio; (5) income stability; (6) the stability of equity value; and (7) the liquidity and size of equity as measured by the market. The functional relationship treated the last four variables listed above as proxies for risk. The model was tested on cross-section data. Although firm size proved to be the most significant, the statistical results as to the signs and magnitude of the various parameters were not clear or precise.

Gordon Model

A more sophisticated single equation least squares model of equity valuation has been put forth by Gordon.[44] The model was specifically designed to indicate what variables explain the value of common stock equities. A multiplicative relation to the dependent variable price was postulated for the following predetermined variables: (1) the dividends of the firm; (2) the expected growth rate in dividends; (3) earnings instability; (4) leverage of the firm;

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[43] Haskel Benishay, "Variability in Earnings-Price Ratios of Corporate Equities," American Economic Review, LI (March, 1961), pp. 209-216.

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

(5) operating asset liquidity; and (6) firm size. Each variable was appended to the overall model after first having been specified in a _ceteris paribus_ relation with price.

Although Gordon's model was methodologically consistent, the presence of multicolinearity among the predetermined variables would necessarily lead to biased parameter estimates. The most prominent innovation of Gordon's model was the functional relationship of the dividend variable to both the firm's dividend payments and the level of those payments.

Bower and Bower Studies

Bower and Bower have constructed two stock valuation models where risk is treated differently in each. The first model hypothesizes that the price-earnings multiple is a function of the non-normal growth rate, the dividend payout rate, and the risk class.[45] The risk class or discount rate is dependent upon the marketability of the stock, the price variability of the stock, the conformity of the stock's price movements with the general market, and certain firm effects. The significant positive relationship between price variability and the price-earnings ratio was interpreted as a reason for examining risk in a portfolio context. The implication in this relationship is that common stock prices may move in accordance with general swings in the market without regard to changes in corporate performance. Thus, the second study

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[45] Richard S. Bower and Dorothy H. Bower, "Risk and the Valuation of Common Stock," _Journal of Political Economy_, LXXVII (May-June, 1969), pp. 349-62.

splits risk into systematic and unsystematic portions of risk.[46] A comparison between an equation including the standard deviation of return as a measure of total risk and an equation in which the risk is split between a systematic component and a residual component was made on the basis of the coefficient of determination. In each of seven years from 1960 through 1966 the adjusted coefficient of determination was higher when the risk was split into separate components, i.e., systematic and residual portions. While the effects of the residual portion of risk were unclear, the systematic risk had a negative affect on the price-earnings ratio in all seven years. This result agrees with the findings of Malkiel.

Litzenberger and Rao Study

The valuation model developed by Litzenberger and Rao splits the market value of the firm's equity into two components.[47] First, the no-growth component discounts the required return per unit of nondiversifiable risk with a certainty equivalent discount rate. In equilibrium, the required return and the certainty equivalent discount rate are assumed equal for all firms at a given point in time. The second component of the model indicates the net

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[46] Richard S. Bower and Dorothy H. Bower, "Test of a Stock Valuation Model," Journal of Finance, XXV (May, 1970), pp. 483-492.

[47] Robert H. Litzenberger and Cherukuri U. Rao, "Portfolio Theory and Industry Cost-of-Capital Estimates," Journal of Financial and Quantitative Analysis, VII (March, 1972), pp. 1433-1462.

present value of future earnings growth and is based on similar work by Miller and Modigliani.[48]

Although unobservable, the expected nondiversifiable risk of the firm's earning to equity is assumed to be linearly related to several instrumental variables. First, the payout ratio relfects management's expectations concerning future earnings and, thus, is expected to be related to investor expectations of the firm's ex ante earnings risk. Second, the riskiness of rates of return on equity is considered to be dependent upon the leverage of the firm. The cyclical elasticity of sales as a measure of the vulnerability of the firm's revenues to the business cycle is treated as the third instrumental variable. Fourth, a market-determined measure of the volatility of financial returns, or systematic risk, is assumed to be independent of measurement error. That is, in an efficient market, stock prices would not be influenced by arbitrary changes in accounting procedures or predicted changes in earnings. Finally, the liquidity of the firm is measured by the current ratio.

Empirical testing over a cross-section of twenty-five chemical firms yielded consistently negative coefficients for the nondiversifiable risk variable. This result agrees with the a priori expectation that investors are risk averse.

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[48] Merton Miller and Franco Modigliani, "Some Estimates of the Cost of Capital to the Electric Utility Industry," American Economic Review, LVI (June, 1966), pp. 333-391.

Macroeconomic Approaches

Several recent studies have attempted to estimate the effect of macroeconomic variables on the general level of stock prices.[49] The most common macroeconomic variables used are the money supply, growth in the money supply, triple A corporate bond rate, and the unemployment rate. Although various forms of these macroeconomic variables have proven to be beneficial in explaining changes in stock prices, several anomolies are evident. First, inconsistencies among the signs and statistical significance of the parameter estimates are found. Second, the results of using the model to predict or simulate actual values of the general level of stock prices are unstable.

Multi-Equation Models

The partial treatment obtained from single equation equity valuation models has become very evident with recent advancements in statistical analysis. As a result, more general and encompassing approaches to equity valuation have emphasized multi-equation models. As in the preceding single-equation models, these systems of equations relate equity value to a complex set of expectations about firm financial variables. Several studies are presented.

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[49] K. E. Homa and D. M. Jaffee, "The Supply of Money and Common Stock Prices," Journal of Finance, XXVI (December, 1971), pp. 1045-66.

M. J. Hamburger and L. A. Kochin, "Money and Stock Prices: The Channels of Influence," Journal of Finance, XXVII (March, 1972), pp. 231-50.

D. M. Jaffee, B. G. Malkiel and R. E. Quandt, "Predicting Common Stock Prices: Payoffs and Pitfalls," Journal of Business Research, II (January, 1972), pp. 1-17.

Miller and Modigliani

The initial work of Modigliani and Miller did not attempt to explain equity valuation.[50] However, the partial model developed in their set of conjectures related the cost of equity capital to the firm risk class, the corporate income tax rate, and the market value debt-equity ratio. Various researchers have tested linear variations of the model relating expected net income per share to the debt equity ratio.[57] These researchers were unable to detect the sign of the debt-equity parameter without model elaboration.

In 1966, Miller and Modigliani changed the emphasis of the model to the development of an explicit valuation theory.[52] The elaboration of the model resulted in a two-stage least squares regression procedure incorporating the following variables: (1) firm value; (2) corporate income tax rate; (3) debt; (4) expected net income; (5) expected dividends; (6) preferred stock; (7) asset growth rate; (8) total assets; and (9) a risk class index. Because the change in statistical procedure emphasized the interaction of variables, the parameter

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[50] Merton Miller and Franco Modigliani, "The Cost of Capital, Corporation Finance and the Theory of Investment," American Economic Review, XXXXVIII (June, 1968), pp. 261-297.

[51] J. Fred Weston, "A Test of Cost of Capital Propositions," Southern Economic Journal, XXX (October, 1963), pp. 105-112.

Alexander Barges, The Effect of Capital Structure on the Cost of Capital, (Englewood Cliffs, New Jersey: Prentice Hall, 1963).

[52] Franco Modigliani and Merton Miller, "Some Estimates of the Cost of Capital to the Electric Utility Industry," American Economic Review, LVI (June, 1966), pp. 333-391.

magnitudes as well as parameter signs become important. However, tests of the model proved the parameters to be unstable.[53]

Lerner and Carleton

The general theory of equity valuation proposed by Lerner and Carleton is perhaps the most universal synthesis of partial models.[54] By utilizing demand and supply considerations, the equity share price is postulated as being jointly determined by capital budgeting (investment opportunities), dividend, and capital structure decisions. As in the Miller and Modigliani model, Lerner and Carleton develop a two-equation system where the independent variables reflect either investor or corporate expectations. Thus, the investor preferences interact with the corporate investment opportunity and activity. The scope and complexity of the Lerner and Carleton theory has pushed empirical testing to the very frontier of existing test methodology without any certain or definite results.

Other Approaches

Warren and Shelton have utilized a completely determined system of equations to predict the financial requirements of a firm for given

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[53] Ronald F. Wippern, "Financial Structure and the Value of the Firm," Journal of Finance, XXI (December, 1966), pp. 615-634.

[54] Eugene M. Lerner and Willard T. Carleton, "The Integration of Capital Budgeting and Stock Valuation," American Economic Review, LIV (September, 1964), pp. 683-702.

Lerner and Carleton, "Financing Decisions of the Firm," Journal of Finance, XXI (May, 1966), pp. 202-214.

assumptions.[55] Instead of seeking to optimize relevant variables, the model merely simulates these variables as a source of relevant decision-making information.

An econometric model of the firm has been developed by J. Walter Elliott.[56] Rather than peruse equity valuation of the firm per se, Elliott's model focuses on the patterns of significant relationships among variables that occur on an intrafirm basis. Furthermore, the model allows the measurement and analysis of multiplier effects associated with changes in exogenous variables.

Summary

This chapter has provided a survey of the development of formal equity valuation procedures. Although valuation models have improved, further adjustments and developments are possible and desired. The next chapter presents the model used in this study as an attempt to further the development of equity valuation models.

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[55] James M. Warren and John P. Shelton, "A Simultaneous Equation Approach to Financial Planning," Journal of Finance, XXVI (December, 1971), pp. 1123-1142.

[56] J. Walter Elliott, "Forecasting and Analysis of Corporate Financial Performance with an Econometric Model of the Firm," Journal of Financial and Quantitative Analysis, VII (March, 1972), pp. 1499-1526.

CHAPTER III

MODEL AND METHODOLOGY

The purpose of this study is to develop and evaluate a valuation model to predict the return to a share of common stock. Specifically, the model simultaneously considers the predictive effects of macroeconomic and microeconomic variables. This chapter developes the valuation model and discusses the method of estimation.

Predictive Model

The intent of this study is to predict the return from holding a share of stock a specified length of time. This return is commonly referred to as the holding period return and is given by the following equation:

$$\widetilde{HPR}^{s}_{t+1} = \frac{\tilde{P}^{s}_{t+1} + \tilde{D}^{s}_{t+1}}{P^{s}_{t}} \qquad (3\text{-}1)$$

where $\widetilde{HPR}^{s}_{t+1}$ is the return for the next one-period time horizon,

$\tilde{P}^{s}_{t+1}$ is the price for stock S at the end of the holding period,

$\tilde{D}^{s}_{t+1}$ represents the dividends that will accrue during the holding period,

P^{s}_{t} is the current price for stock S, and

$\sim$ indicates a random variable.

The forecasted holding period return requires the prediction of price appreciation or depreciation and the prediction of any dividends that may be received for a given time horizon. Because dividends are relatively stable over long periods of time, the forecast of $\tilde{D}^s_{t+1}$, denoted by $\hat{D}^s_{t+1}$, is not expected to be too difficult. However, forecasting $\tilde{P}^s_{t+1}$, given by $\hat{P}^s_{t+1}$, is another matter.

A security valuation approach that allows the prediction of $\hat{P}^s_{t+1}$ is given by the well-known formulation:

$$\hat{P}^s_{t+1} = \frac{\hat{E}^s_{t+1}}{\widehat{(E/P)}^s_{t+1}} \tag{3-2}$$

where $\hat{E}^s_{t+1}$ is estimated earnings one period hence, and

$\widehat{(E/P)}^s_{t+1}$ is the estimated capitalization rate one period hence.

Therefore, an accurate prediction of $\tilde{E}^s_{t+1}$ and $\widetilde{(E/P)}^s_{t+1}$ will allow the prediction of $\tilde{P}^s_{t+1}$.

As is suggested in Equation 3-1, the holding period return is estimated by forecasting $\tilde{D}^s_{t+1}$, $\tilde{E}^s_{t+1}$, and $\widetilde{(E/P)}^s_{t+1}$. The prediction of either dividends or the earnings-price ratio requires coincident consideration of earnings for a given time period. Besides being a function of the overall activity of the economy, the price investors are willing to pay for a dollar of earnings if related to the actual amount of earnings generated by the corporation. Likewise, the dividends investors expect to receive are related to the earning performance of the corporation for the given time period. Because actual earnings are unknown for the holding period, the prediction of dividends and the earnings price ratio must be based, in part, on predicted earnings. Therefore, estimation of $\tilde{D}^s_{t+1}$, $\tilde{E}^s_{t+1}$, and $\widetilde{(E/P)}^s_{t+1}$ cannot be accomplished independently of each other.

This study will attempt to predict these values by utilizing a system of simultaneous equations where the parameters are estimated by two-stage least squares. More specifically, the system of equations will describe the interrelationships among the various micro- and macroeconomic variables pertinent to the firm that give rise to values for these variables. The specification of and rationale for each equation follows.

Earnings Per Share

The first structural equation predicts earnings per share E^s_{t+1} for the next time period as follows:

$$E^s_{t+1} = a_0 + a_1 GNP_{t+1} + a_2 E^s_t + a_3 (D/E)^s_t + u_1 \qquad (3\text{-}3)$$

where E^s_t = normalized earnings for security s,

GNP_{t+1} = gross national product,

$(D/E)^s_t$ = dividend payout ratio for security s, and

u_1 = error term,

and where the subscripts on the variables denote the respective time period, i.e., t is the current time period, t+1 is the next time period, etc. All time periods are considered to be three months or one quarter.

The specification of GNP as a coincident explanatory variable is supported by Anderson's contention that output and income affect corporate profits, i.e., earnings.[57] Because the firms are within the corporate sector of the economy, the equation was initially specified with total corporate profits rather than GNP. However, even though GNP includes all economic sectors, the prediction of earnings using GNP was superior to the prediction using aggregate corporate profits. This superiority of GNP over corporate profits in predicting earnings supports the initial contention of this study that corporate performance should be evaluated with regard to the entire economy.

The superiority of GNP over aggregate corporate profits in the estimating process was determined on the basis of R^2, the coefficient of determination. Discussion concerning the applicability of R^2 as an evaluative statistic in a system of simultaneous equations is deferred until the next chapter.

Because GNP is estimated outside the model, this variable is considered exogenous. Predictions of GNP are available from the St. Louis Federal Reserve Model, the Wharton Model, and others. However, these sources have not provided estimates of GNP for the entire length of the test period for this

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[57] Theodore A. Andersen, "Trends in Profit Sensitivity," The Journal of Finance, XVII (December, 1963), pp. 637-646.

study. Therefore, GNP for this study was estimated as a simple linear function of GNP on the previous quarter GNP, i.e.,

$$GNP_{t+1} = \alpha_0 + \alpha_1 GNP_t + e \qquad (3\text{-}4)$$

Evaluation of this estimation process revealed excellent predictive power, relative freedom from serial correlation, etc.

Most recent valuation literature concurs in the suggestion that earnings of firms should be normalized in some manner. However, no resounding agreement as to the "best" way for normalizing earnings is evident. In an early model, Whitbeck and Kisor defined normalized earnings as earnings in a "normal" year, presumably an average of earnings during mid-business cycle years.[58] In a later study Ahlers utilized analysts estimates in weighing past earnings to develop a normalized trend in earnings.[59] Other methods are also existent. Whatever the method, the desired effect of normalizing earnings is to minimize the influence seasonal fluctuations may have on the long term trend. However, the effects of cyclical movements should be recognized. Thus, for this study, earnings were normalized by calculating a four-quarter moving average of reported earnings such that the average value was placed in the lead quarter. Other, more sophisticated normalizations, such as

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[58] Volkert S. Whitbeck and Manown Kisor, Jr., "New Tool in Investment Decision Making," Financial Analysts Journal, XIX (May-June, 1963), p. 56.

[59] David M. Ahlers, "SEM: A Security Evaluation Model," in Analytical Methods in Banking, ed. by Kalman J. Cohen, and Frederick S. Hammer (Homewood, Illinois: Richard D. Irwin, Inc., 1966), p. 308.

exponential smoothing techniques, are possible but were not used in the research reported here.

Much has been written in recent years about the flexibility of accounting techniques as concerns the reporting of corporate earnings. Due to changes in depreciation policy, treatment of pension plans, consideration of extraordinary or nonrecurring items, etc., the possibility of significant changes in reported earnings has been demonstrated. Rather than attempt to adjust the reported earnings data for possible "discretionary" accounting irregularities, this study considered the earnings data as reported for the following two reasons. First, without internal auditing information, the identification and treatment of specific irregularities is impossible. Second, and more importantly, Kaplan and Roll indicated that security prices increased around the date of reported earnings increases regardless of whether the earnings inflation was due to accounting manipulation or improved corporate performance.[60] Kaplan and Roll also showed that subsequent adjustments in the stock price were forthcoming if investors learned that earnings had been manipulated. However, investors' initial reaction seems to be to accept reported earnings at face value. Therefore, this study assumes that investors react in good faith to reported earnings. To increase the likelihood that reported earnings have not been seriously manipulated, the sample of firms studied in this paper

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[60] Robert S. Kaplan and Richard Roll, "Investor Evaluation of Accounting Information: Some Empirical Evidence," Journal of Business, XXXV (April, 1972), pp. 225-257.

was drawn from bluechip companies whose earnings quality were regarded highly by Standard and Poor's as measured by the S+P Earnings Quality Index.

The use of past or historical earnings to predict future earnings has been debated in the literature. A study by Cragg and Malkiel compared forecasts of earnings growth based on historical data against forecasts made by security analysts.[61] The forecasts by analysts with inside information were not significantly better than the forecasts based on historical data. Other studies have revealed similar findings.[62] Because predicted earnings have not been proven superior to historical data, this model will consider earnings to be fundamentally related to past earnings, as expressed above in equation 3-3.

The dividend payout ratio is expected to have a negative affect on future earnings. This relationship should hold for two reasons. First, larger dividends with respect to earnings imply less opportunity for earnings growth financed through internal funds, i.e., retained earnings. Second, decreased retained earnings implies a somewhat larger cost of capital because of the need to finance investments externally. Thus, earnings should be negatively

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[61] J. G. Cragg and Burton G. Malkiel, "The Consensus and Accuracy of Some Predictions of the Growth of Corporate Earnings," The Journal of Finance, XXII (March, 1968), pp. 67-84.

[62] Philip Brown and Victor Niederhoffer, "The Predictive Content of Quarterly Earnings," Journal of Business, XXXXI (October, 1968), pp. 488-497.

David Green and Joel Segall, "The Predictive Power of First-Quarter Earnings Reports," Journal of Business, XXXX (January, 1967), pp. 44-55.

related to the payout ratio. It should be noted that D/E is defined using normalized earnings as discussed above.

Earnings-Price Ratio

The second structural equation predicts the earnings-price ratio for the holding period, where once again E/P is defined using normalized earnings. The specification is given as:

$$(E/P)^s_{t+1} = b_0 + b_1 GNP_{t+2} + b_2 NU_{t+1} + b_3 MS_t + b_4 AAA_t + b_5 (D/E)^s_t + b_6 \hat{E}^s_{t+1} + b_7 (E/P)^s_t + u_2 \qquad (3\text{-}5)$$

where GNP = gross national product,

NU = unemployment rate,

MS = money supply,

AAA = long-term, corporate bond interest rate,

E = predicted earnings for the holding period,

D/E = dividend payout rate,

E/P = earnings-price ratio, and

u_2 = error term.

Of the various macroeconomic variables considered, interest rates and money supply have received the most consideration in previous studies. In an early study, Tinbergan found the long-term interest rates to be inversely proportional to stock prices.[63] The results of a more recent study by Keran

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[63] Jan Tinbergan, "The Dynamics of Share-Price Formation," Review of Economics and Statistics, XXI (November, 1939), pp. 153-160.

support the importance of interest rates found by Tinbergan.[64] Furthermore, studies by the National Bureau of Economic Research and others, indicate that a change in the level of stock prices is preceded by changes in the money supply and interest rates by three to four months.[65] Although some scholars have disagreed with the exact timing, this study assumes that the money supply (MS) and interest rates (AAA) change prior to changes in stock prices. Thus, the model considers MS and AAA to be known (exogenous) at the time of E/P estimation. The ultimate value of this assertion is, of course, subject to evaluation in the examination of the predictive results.

Evidence seems to indicate that changes in gross national product usually follow stock price changes by three to four months. However, the timing of unemployment changes with respect to stock price changes is less certain. Therefore, for lack of contrary theoretical or empirical evidence, the unemployment rate (NU) is specified as being coincident with movements in the earnings-price ratio.

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[64] Michal W. Keran, "Expectations, Money, and the Stock Market," Review, Federal Reserve Bank of St. Louis (January, 1971), pp. 16-31.

[65] Milton Friedman and Anna Schwartz, A Monetary History of the United States (Princeton, NJ: Princeton University Press, 1963).

Geoffrey H. Moore and Julius Shiskin, Indicators of Business Expansions and Contractions (New York: National Bureau of Economic Research, Inc., 1967).

Beryl W. Sprinkel, Money and Markets: A Monetarists View (Homewood, Illinois: Richard D. Irwin, Inc., 1971).

Because the values for GNP and NU are not known at the time the earnings-price ratio (E/P) is estimated, these values must also be predicted. The estimation procedure for both GNP and NU is to utilize the parameter estimates from a simpler linear regression of the form given in Equation 3-4 and then estimate GNP as $GNP_{t+2} = f(GNP_t)$ and NU as $NU_{t+1} = g(NU_t)$. In both cases the estimating procedure is external to the model, and therefore, both GNP and NU are considered to be exogenous variables.

As discussed above, more sophisticated procedures for estimating GNP and NU are available from the various macroeconomic models. However, because many of these models were developed late in the time horizon of this study, complete estimates are not available. Furthermore, more precise estimates of GNP, etc., should only serve to improve the results of this model. As will be illustrated later, the model studied here provides excellent results even with these naive estimation structures.

Several other macroeconomic variables were considered. As in the earnings equation, aggregate corporate profits were found to be inferior to GNP in the E/P equation. (As above, the inferiority was measured via R^2).

Investor expectations about inflationary growth in the economy was initially measured by the Consumer Price Index (CPI). However, the CPI was dropped from the equation after tests indicated that a high degree of multicolinearity existed between the CPI and AAA. When analyzed separately, the AAA provided more explanatory power in the equation. Also, GNP was measured on both a real and nominal basis. Nominal GNP, elimination of the CPI, and AAA provided the best results.

Finally, the impact of foreign trade was analyzed in two separate ways. First, the nation's balance of payments was found to have very little effect on the level of stock prices for a variety of lag structures. Second, an attempt was made to relate stock prices to a relatively strong foreign currency. Because of the decreasing value of the dollar relative to Deutsch Marks, the price of Deutsch Marks was analyzed. As with the balance of payments, the Deutsch Marks exhibited very little ability to explain stock price movements. In both cases, the coefficient of determination decreased. This result is attributed to the relatively minor share of Gross National Product derived from foreign trade.

Although the price of a stock is certainly related to general economic conditions, the internal operations of the firm are also considered by the investing public. Therefore, three microeconomic or firm variables are included in Equation 3-5. The variables included are the dividend payout ratio (D/E), an estimate of future earnings, and the lagged earnings-price ratio.

Gordon contends that current dividends are less uncertain than future earnings and thus are more important in determining the current price.[66] However, a recent study by Latane and Tuttle indicates that earnings and retained earnings explain price ratios more efficiently than dividends.[67] The

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[66] Myron J. Gordon, "Dividends, Earnings and Stock Prices," Review of Economic Statistics, XXXXI (May, 1969), p. 105.

[67] Henry A. Latane and Donald L. Tuttle, "An Analysis of Common Stock Price Ratios," Southern Economic Journal, XXXIII (January, 1967), p. 353.

use of D/E as an exogenous explanatory variable indirectly considers both arguments. First, the dividend payout ratio indicates the amount of earnings paid out in dividends. Second, one minus D/E is a measure of retained earnings for the corporation. Investors interpret retained earnings as a proxy for future investment and additional earnings. Thus, Equation 3-5 specifies D/E as a lagged variable indicating that current dividend (retained earnings) policy affects future price.

The study by Latane and Tuttle indicates that on the average over seventeen percent of the variation in price changes was explained by changes in earnings during the fourteen years from 1950 through 1963.[68] Furthermore, a study by Latane, Joy, and Jones found that future earnings were more useful than current or past earnings in the prediction of future price or price multiples.[69] Therefore, the earnings variable in Equation 3-5 is used as an explanatory variable of the earnings-price ratio at the end of the holding period. However, the predicted earnings variable is the dependent variable in Equation 3-3 and thus is also endogenous in Equation 3-5. This problem is overcome by utilizing two-stage least squares estimation techniques. A discussion of this method will follow in the next section.

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[68] Ibid, p. 350.

[69] Henry A. Latane, O. Maurice Joy, and Charles P. Jones, "Quarterly Data, Sort-rank Routines, and Security Evaluation," Journal of Business, XXXXIII (October, 1970), pp. 434-437.

The inclusion of the lagged earnings-price (E/P) ratio is a result of recent studies by Latane, et al.[70] Latane found that normalized E/P ratios were useful in predicting future price changes. Furthermore, the most recent quarterly E/P ratios had the largest "information effect" with regards to future prices. This result implies that the stock market is not perfectly efficient and that investors react over a short period of time rather than instantaneously. Thus, a lagged E/P is expected to be positively related to future earnings-price ratios.

The initial specification of the E/P equation included a proxy for risk. Because this study is an attempt to predict common stock returns over time for individual securities, a total risk measure was used. Because recent studies by Miller and Scholes, and Fama and MacBeth show that the residual risk variable is important,[71] the risk proxy did not distinguish between

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[70] Henry A. Latane and Donald L. Tuttle, "An Analysis of Common Stock Price Ratios," Southern Economic Journal, XXXIII (January, 1967), pp. 343-354.

Henry A. Latane, Donald L. Tuttle, and Charles P. Jones, "E/P Ratios versus Changes in Earnings in Forecasting Future Price Changes," Financial Analysts Journal, XXV (January-February, 1969), pp. 117-123.

[71] Merton H. Miller and Myron S. Scholes, "Rates of Return in Relation to Risk: A Reexamination of Recent Findings," in Studies in Theory of Capital Markets, ed. by Jensen (Praeger Press, 1972).

Eugene F. Fama and James D. MacBeth, "Risk, Return and Equilibrium: Empirical Tests," Journal of Political Economy, LXXXI (May, 1973), pp. 607-636.

systematic and unsystematic risk as does the Beta coefficient in Sharpe's capital asset pricing model.[72]

The risk measure used was developed by Hasty and Fielitz and considers growth in returns, a characteristic not common to the traditional variance of returns.[73] The risk variable is defined as the adjusted standard error of regression for the cumulative investment value regressed over time. The cumulative investment value is defined as the value to which a beginning share of the investment would have grown if all cash throwoffs, such as dividends had been immediately reinvested in the same investment. By considering growth over time, the risk measure is not subject to irregularities based on estimation during different segments of the time interval. Furthermore, in contrast to the Beta coefficient, all elements of risk are considered.

The risk proxy was discarded as an explanatory variable in the E/P equation for two reasons. First, on the basis of R^2 values, the risk measure did not improve the explanatory ability of the E/P equation. Second, the signs of the risk variables were not consistent among the five specification-sample firms.

The failure of the risk variable to provide meaningful improvement in the model specification is undoubtedly due to the time series, as opposed to

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[72] William F. Sharpe, Portfolio Theory and Capital Markets (New York, N.Y.: McGraw-Hill, 1970).

[73] John Hasty and Bruce Fielitz, "An Investment Performance Analysis Model for Heterogeneous Investment Time Horizons," Proceedings, 5th Annual AIDS, V (November, 1973). To be published.

cross-sectional, nature of the study. The riskiness of the firm as measured by variability of returns over time is accounted for by the variation over time in other variables in the study. In a time series analysis, almost every explanatory variable is a proxy for risk. The exclusion of a specific risk variable from this study is consistent with other time series results.[74]

Dividends Per Share

The final equation in the HPR model estimates the value of dividends and is specified as follows:

$$D^s_{t+1} = c_0 + c_1 D^s_t + c_2 (D/E)^s_t + c_3 \hat{E}^s_{t+1} + u_3 \qquad (3\text{-}6)$$

where E = predicted earnings for the holding period,

D = dollar amount of dividends,

D/E = dividend payout rate, and

u_3 = error term.

The predicted earnings variable is the same variable used in Equation 3-5, and is estimated in the first stage regression. Because dividends are usually paid from current earnings, an estimate of earnings seems relevant when estimating dividends.

Both the amount of dividends paid (D) and the level of dividends with respect to earnings (D/E) are included in the equation to account for different

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[74] Dwight M. Jaffee, Burton G. Malkiel, and Richard E. Quandt, "Predicting Common Stock Prices: Payoffs and Pitfalls," Journal of Business Research, II (January, 1974), pp. 1-16.

dividend policies of different firms. Provided earnings are positive, a constant D/E guarantees the retention of earnings to provide for future earnings from which future dividends may be paid. On the other hand, corporations that pay a specific dollar amount of earnings usually change that amount only after earnings have stabilized at a level consistent with future expectations of the corporation. This so called "information content" of dividends was first identified by Miller and Modigliani.[75] Therefore, unless future earnings expectations change, dividends for the next quarter will be related to current dividends nearly on a one-to-one basis.

The HPR model, as theoretically stated in Equations 3-1 and 3-2 and specified in Equations 3-3, 3-4, and 3-5, will be used to estimate the holding period return for a sample of stocks. The procedure used here is to simply state the estimating results for $\tilde{E}^s_{t+1}$, $\widetilde{(E/P)}^s_{t+1}$, and $\tilde{D}^s_{t+1}$. Before reporting the results of testing this model, the procedures of model estimation will be reviewed.

Statistical Model Estimation

As discussed above, the holding period return model used in this study consists of three equations. Of these, the E/P and D equations contain the simultaneous estimate of earnings as an explanatory variable. Because of this simultaneity, the estimation of each equation independently by the method of

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[75] Merton H. Miller and Franco Modigliani, "Dividend Policy, Growth and the Valuation of Shares," Journal of Business, XXXIV (October, 1961), p. 427.

ordinary least squares (OLS) will yield biased parameter results. Furthermore, the parameter estimates will not be consistent, i.e., the parameter estimates will not approach the true population parameters as the size of sample increases. Thus, a method of estimation other than OLS must be considered.

Methods of estimation for simultaneous systems can be considered in two broad classes: those that make use of information in all equations of the system, and those that make use of information relative to a certain subsystem, where the term subsystem is usually taken to consist of a single equation. Estimators belonging to the first class are termed full information estimators, while those belonging to the second class are termed limited information estimators. Examples of full information estimation techniques are three-stage-least squares (3SLS), and full-information-maximum-likelihood (FIML), while examples of the limited information techniques include indirect-least-squares (ILS), two-stage-least squares (2SLS), and limited-information-maximum-likelihood (LIML). In general, these methods all yield consistent estimates, although the estimates are still biased. Extensive discussions of each of these methods can be found in Johnston or Theil.[76]

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[76] J. Johnston, Econometric Methods (2nd. ed.; New York: McGraw Hill, 1972), pp. 408-420.

Henri Theil, Principles of Econometrics (New York: John Wiley and Sons, Inc., 1971), pp. 528-537.

For the above stated estimation techniques, the establishment of large-sample properties is possible. However, in general, identification of small-sample properties for these methods is not possible. But the samples that must be dealt with in practice are typically small, seldom exceeding 80 or so observations. (In this study approximately 40 observations are available.) Thus, it is of great interest to inquire into the properties of estimators for the typical sample sizes encountered in practice.

For example, while 2SLS and LIML estimators can be shown to be asymptotically equivalent (the same is true with respect to 3SLS and FIML), the actual estimators in these techniques may differ systematically in small samples. Also, while 2SLS and LIML are less efficient than 3SLS and FIML estimators, the question for small samples is open to debate. In addition, there is the added complication that, while in limited information techniques reliance is placed solely on the explicit specification of the particular equation being considered, with full information techniques every equation in the system must be exactly specified. Thus, the risk of misspecification error is higher with full information methods, and this error propagates throughout the entire system even though the error may be present in only one equation.

Another question that should be answered is whether or not OLS, in small samples, is sufficiently inferior to simultaneous equation techniques to warrant its complete exclusion from serious consideration as an estimation procedure for structural parameters.

The above considerations are of great practical importance, and some tentative results have been suggested in terms of Monte Carol simulations. The state of current knowledge on the various structural coefficient estimators is well summarized in Johnston. For example, Summers[77] shows that in approximating the true parameter coefficients, the FIML estimates are best. When specification errors and/or multicollinearity are present, 2SLS is superior with regards to accuracy. When specification errors alone are present, FIML and 3SLS are the most biased, and 2SLS, LIML, and OLS show about equal bias in estimating the structural coefficients.

In general, the experiments summarized in Johnston give no clear-cut guidelines for the choice of an estimation technique for econometric models. The test results do suggest that the consistent estimators do not vary greatly. Also, their relative performances are sensitive to the data and to the structure studied. Thus, 2SLS may be the best estimator to choose since it is cheapest, easiest to compute, and provides comparable statistical properties. Hence, 2SLS is used to estimate the HPR model in this study. (It should be noted that the reduced form estimation procedure of indirect least squares is immediately eliminated from consideration because the HPR model is overidentified.)

As the name implies, the two-stage-least-squares method is accomplished in two steps or stages. In the first stage, the endogenous explanatory

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[77] R. Summers, "A Capital Intensive Approach to the Small-Sample Properties of Various Simultaneous Equation Estimators," Econometrica, XXXIII (January, 1965), pp. 1-41.

variables are regressed on all other predetermined variables to provide estimates of the endogenous explanatory variables. The estimated endogenous explanatory variables are then substituted into the original structural equations and the second-stage regression of the structural equations is performed.

Before discussing the results of the HPR model, a brief discussion of standard power tests is in order. Debate over the relative merits of the standard t-tests in simultaneous systems has concluded that t-tests are technically not correct and should not be used in the same context as t-tests in single equation estimating procedures. This conclusion arises because the sampling distributions of estimated coefficients only approach normality as the sample size increases. Furthermore, the moments of the sampling distribution are finite only as the sample size approaches infinity. Thus, for small samples, infinite moments imply an inability to calculate meaningful tests of statistical inference of the variable coefficients. A discussion of these characteristics is presented by Basman and Theil.[78]

In regard to this study, this chasm in statistical applicability is not uncrossable. Since this paper is designed to predict the holding period returns

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[78] R. L. Basman, "A Note on the Exact Finite Sample Frequency Functions of Generalized Classical Linear Estimators in Two Leading Over-Identified Cases," Journal of the American Statistical Association, LVI (September, 1961), pp. 619-636.

R. L. Basman, "A Note on the Exact Finite Sample Frequency Functions of Generalized Classical Linear Estimators in a Leading Three Equation Case," Journal of the American Statistical Association, LVIII (March, 1963), pp. 161-171.

Theil, Principles of Econometrics, pp. 484-500.

of common stocks over time, the relative usefulness of certain variables can be determined on the basis of two criteria. First, the signs of the variables should be consistent with a priori expectations and theory. Second, the fit of the estimating equations as measured by the coefficient of determination (R^2) should be improved if a variable has predictive ability. Again, as measured in 2SLS, the R^2 value and any tests of significance relative to R^2 are not statistically correct. However, R^2 is useful as an index of fit since it is familiar to empirical analysts.

For the same reason that specific tests of significance on the parameter coefficients (t-tests) and the equation as a whole (F-test) cannot be carried out, tests for serial correlation are also not appropriate. However, to the extent that the usual Durbin-Watson statistic has meaning in simultaneous systems (only as index value similar to R^2) as a measure of serial correlation, the Durbin-Watson statistic will be used as a guideline during the model estimation.

As specified earlier, the HPR model is estimated using 2SLS in the following sequence. First, the coincident endogenous explanatory variable (E_{t+1}) is estimated by regressing it on all other predetermined variables. This first-stage estimate of E_{t+1} is then substituted into the E/P and D equations. Second, the second stage regressions estimate the original E, E/P, and D structural equations in the model. The data used and results of this estimating procedure will be discussed in Chapter Four.

CHAPTER IV

EMPIRICAL EVALUATION

The theoretical HPR model developed in Chapter III was tested and evaluated on a sample of common stocks from the New York Stock Exchange. The results of this empirical investigation are presented in this chapter in the following manner. First, the choice of firms and adjustment of data is discussed. Second, the relative value of each of the explanatory variables is discussed followed by an evaluation of the goodness-of-fit of the model. The predictive ability of the model is analyzed, and finally, the stability of the model is evaluated.

Characteristics of Empirical Structure

Data

The HPR model was estimated on quarterly, time series data over the period from 1960 through 1970. The necessary macroeconomic data was obtained from the Survey of Current Business, the Federal Reserve Bulletin, the Monthly Labor Review, and Business Conditions Digest. Gross national product, money supply (cash plus demand deposits), and unemployment data were seasonally adjusted. The interest rates used were the triple A, corporate bond rates.

Microeconomic data was collected from Moody's, The Wall Street Journal, and the ISL Daily Stock Price Index. The raw earnings, price and dividend data were transformed to derive the appropriate normalized E/P and D/E ratios, and the normalized earnings. The quoted prices were the closing prices for the last active trading day for the calendar quarters. Dividends and earnings were assigned to the quarters within which the economic activity occurred. Furthermore, care was taken to make sure all data was available at the beginning of the holding period.

Sample Selection

The model was initially specified on a sample of five corporations, and was then tested on five additional firms for comparative results. For each sample, the model was estimated on observations from the second quarter of 1961 through the fourth quarter of 1970. Because of the smoothing of earnings and the lagged values of several micro- and macroeconomic variables, the first five observations were deleted in specifying the model. The ten firms were chosen from the list of thirty Dow-Jones Industrials according to the following criteria: (1) availability of microeconomic data from 1960 through 1971; (2) a minimum of stock splits and dividends to avoid massive data adjustment; and (3) representation of various industries.

The firms and industries represented include: (1) American Can - containers and packaging products; (2) Bethlehem Steel - steel and shipbuilding; (3) General Foods - packaged foods; (4) International Harvester - farm equipment; (5) Johns-Manville - building materials; (6) Owens-Illinois - glass; (7) United States Steel - steel; (8) Union Carbide - chemicals; (9) United Aircraft - aircraft engines; and (10) Woolworth - chain retail stores. The diversity of firm and industry representation is designed to test the generality of the HPR model.

Evaluation of Explanatory Variables

Because the firms represent different industries, the variables are not expected to affect all the firms to the same degree. However, broad patterns of the effects on firms should be evident, which in turn should be useful in analyzing the merits of the HPR model. Some of the patterns evident in the specification and testing of the model are now discussed.

Macroeconomic Variables

The suggested importance of the macroeconomic variables appears to be validated. With the exception of United States Steel, gross national product had a negative effect on the earnings-price ratio for all firms. This result is consistent with a priori expectations. As GNP increases, corporate earnings are also expected to increase, and P/E multiples can be expected to rise (E/P decreases) in anticipation of future advances in the economy.

The effects of GNP in the earnings equation are mixed with four of the ten firms showing a negative relationship between E and GNP. This divergence from the expected positive relationship is probably attributable to the time response of different firms and industries in regard to general economic stimuli.

In keeping with the generality of the model, the exact time lags for each firm cannot be identified. However, the mixed sign situation is not interpreted as detracting from the value of GNP as an important influence on corporate earnings, especially in light of the debate in the current financial literature regarding the correct lag structure specification between GNP and the entire level of stock prices.[79]

The corporate bond rate (AAA) demonstrated a positive influence on the E/P ratio in eight of the ten firms. This result is consistent with the negative relationship in eight of the ten firms in the first-stage earnings equation. As interest rates rise, economic activity and corporate earnings decrease. However, as corporate earnings decrease, the price of the common stock will decrease at a faster rate. The end result is that the E/P ratio will also increase.

The effect of the money supply variable on E/P is mixed among the ten firms. This result is consistent with the results obtained by Elliott for real sales.[80] Some degree of multicolinearity with other macroeconomic variables was exhibited by the money supply variable. However, deletion of money supply

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[79]Kenneth E. Homa and Dwight M. Jaffee, "The Supply of Money and Common Stock Prices," Journal of Finance, XXVI (December, 1971), pp. 1045-66.

Burton G. Malkiel and Richard E. Quandt, "The Supply of Money and Common Stock Prices: Comment," Journal of Finance, XXVII (September, 1972), pp. 921-26.

[80]J. Walter Elliott, "Forecasting and Analysis of Corporate Financial Performance with an Econometric Model of the Firm," Journal of Financial and Quantitative Analysis, VII (March, 1972), p. 1513.

as an explanatory variable caused the overall predictive ability of the E/P equation to deteriorate substantially. Thus, the money supply variable was included.

The effect of unemployment is consistently negative to changes in the E/P ratio. Experimentation with simple one quarter lead and lag structures did not change the results. However, research available from the NBER suggests that a longer lag structure might be appropriate.

Microeconomic Variables

In general the results of the microeconomic variables are in agreement with a priori expectations. The lagged E/P explanatory variable in the E/P equation was positive for all ten firms and is interpreted as measuring a tendency toward persistence in the level of investor expectations.

A consistently positive relationship between predicted earnings and E/P was found. This result is seemingly contrary to expected results. However, Nicholson found that earnings rise faster than prices, which supports the positive effects of E on E/P obtained in this study.[81] Also, a phenomenon characteristic of the decade of the sixties is that the overall level of P/E ratios dropped even though earnings were stable or improving. Therefore, because of the strength of consistency of results, the results are not interpreted as being totally contrary to expectations.

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[81] S. Francis Nicholson, "Price-Earnings Ratios," Financial Analysts Journal, XVI (July-August, 1960), pp. 43-45.

The effects of predicted earnings in the dividend equation are mixed. This result indicates that some firms pay little attention to short term fluctuations in earnings when establishing dividend policy. Indeed, the dividend policy of the ten firms is predominantly a constant dollar dividend policy. This interpretation is supported by the mixed effects of the dividend payout ratio. Even though the signs are not completely consistent for all firms, the dividend equation as specified predicted the direction of two of the three dividend changes during the trial prediction period. These results will be discussed later.

In support of a priori expectations, the lagged dividend payout ratio exhibited consistently negative effects on predicted earnings. This result implies that future earnings are related to past retained earnings. In the E/P equation the signs of the lagged dividend payout ratios are mixed. Thus, the model is not able to shed light on the longstanding controversy over the relative merits of dividends versus retained earnings in determining price multiples. Finally, as expected, lagged earnings and lagged dividends exhibit consistently positive predictive ability on the respective earnings and dividend equations.

Goodness-of-fit

Evaluation of the overall goodness-of-fit of the model is done for both th. specification sample and the comparative sample in Tables 1 and 2, respectively, by presenting the R^2 values from the appropriate regressions. As shown in the tables, three indicators of fit are used. First, the fit of the

TABLE 1

SUMMARY GOODNESS-OF-FIT STATISTICS
Quarterly, 1961-2 through 1970-4

Firm

Endogenous Variables		1	2	3	4	5
	1	.9546	.7914	.9979	.9606	.9482
E	2	.9494	.7513	.9978	.9287	.9329
	S	-1	-	-	-	-
	1	-2	-	-	-	-
E/p	2	.8661	.8136	.8645	.7987	.7033
	S	.8658	.7933	.8478	.7436	.6688
	1	-2	-	-	-	-
D	2	.9201	.8450	.9725	.9659	.9337
	S	.9198	.8267	.9695	.9637	.9261

1 Same as second stage
2 Not included in first stage

Row Identification:
1 - first-stage results
2 - second-stage results
S - simulation results

Firm Identification:
1 - American Can
2 - Bethlehem Steel
3 - General Foods
4 - International Harvester
5 - Johns-Manville

TABLE 2

SUMMARY GOODNESS-OF-FIT STATISTICS
Quarterly, 1961-2 through 1970-4

Firm

Endogenous Variables		1	2	3	4	5
	1	.9419	.7202	.9443	.9787	.9546
E	2	.9272	.6979	.9230	.9677	.9236
	S	-1	-	-	-	-
	1	-2	-	-	-	-
E/p	2	.7446	.8115	.8824	.7576	.8187
	S	.7324	.8072	.8778	.7520	.8170
	1	-2	-	-	-	-
D	2	.9113	.8482	.9021	.9440	.9377
	S	.9064	.8210	.9018	.9348	.9375

1 Same as second stage
2 Not included in first stage

Row Identification:
1 - first-stage results
2 - second-stage results
3 - simulation results

Firm Identification:
1 - Owens-Illinois
2 - United States Steel
3 - Union Carbide
4 - United Aircraft
5 - Woolworth

first-stage equation regressing the endogenous variable on all predetermined variables is presented. Second, the fit of the three structural equations is presented for both groups of firms. Finally, the fit of a simulation of the structural equations regressing the endogenous variable on only the exogenous variables is presented, i.e., the simulation equations do not include the endogenous explanatory variables. As stated earlier, formal goodness-of-fit tests as measured by R^2 are technically not appropriate for simultaneous systems. However, the R^2 values provide a usable, familiar index of fit to aid in evaluating the HPR model.

The overall high R^2 values indicate that the model fits the data of the ten corporations quite well. Although the results are possibly affected by some slight autocorrelation and multicolinearity, the deletion of "problem" variables in the specification stage has attempted to minimize these possible injurious effects.

Several conclusions are observable. First, because the fit of the second-stage E equation is not much worse than the first-stage fit, serious specification errors in the model do not seem to be present. The two firms with somewhat lower R^2 values are both from the steel industry, an industry with erratic earnings even during the growth oriented mid-1960's. Although E/P and D do not have first-stage regressions, the close similarity between R^2 values of the second-stage regressions and the simulations also indicates an absence of severe specification errors. Furthermore, support for the endogenous variable E as an explanatory variable in E/P and D is generated by the lower simulation R^2 values for each firm.

Finally, Table 3 presents R^2 values for each of the structural equations as estimated using both normalized and unnormalized earnings data. As suspected, the use of normalized earnings is clearly superior to unnormalized earnings for the E and E/P equations. Because of the constant-dollar dividend policy of all ten firms, the difference between using normalized versus unnormalized earnings in the dividend equation is minimal.

Predictive Ability of the HPR Model

Although the model fits the data quite well, a more demanding evaluation concerns the ability of the model to predict. The predictive ability of the model is analyzed by comparing predicted values of E, E/P, and D against actual values for the four quarters of 1971. Predictions for each equation are made for two quarters in the future. Thus, predictions for the model estimated through 1970 are made for the first two quarters of 1971 for each of the ten firms. Then the model is reestimated through the second quarter of 1971 and predictions are made for the last two quarters of 1971. Thus the prediction periods are adjacent to the specification time horizon.

Actual Predictions

The results of the HPR model as presented in Table 4 are reasonable. The first- and second-stage predictions (hereafter P_1 and P_2) for the earnings

TABLE 3

COMPARATIVE GOODNESS-OF-FIT STATISTICS

Normalized Versus Unnormalized Earnings Data
Quarterly, 1961-2 through 1970-4
Structural Equations Only

Endogenous Variables		Firms 1	2	3	4	5
E	N	.9494	.7513	.9978	.9287	.9329
	U	.2173	.1923	.8289	.0758	.3039
E/P	N	.8661	.8136	.8645	.7987	.7033
	U	.2020	.3922	.7295	.2501	.3890
D	N	.9201	.8450	.9725	.9659	.9337
	U	.9091	.8334	.9697	.9608	.9329

		6	7	8	9	10
E	N	.9272	.6979	.9230	.9677	.9236
	U	.5056	.1039	.7207	.6452	.1492
E/P	N	.7446	.8115	.8824	.7576	.8187
	U	.4157	.3689	.8037	.3373	.4074
D	N	.9113	.8482	.9021	.9440	.9377
	U	.9008	.8678	.9036	.9405	.9414

Firm Identification:

1. American Can
2. Bethlehem Steel
3. General Foods
4. International Harvester
5. Johns-Manville
6. Owens-Illinois
7. United States Steel
8. Union Carbide
9. United Aircraft
10. Woolworth

Row Identification:

N - Normalized Data
U - Unnormalized Data

TABLE 4: ACTUAL (NORMALIZED) VERSUS PREDICTED VALUES FOR E, E/P, AND D

		American Can					Bethlehem Steel				
		1970-4	1971-1	1971-2	1971-3	1971-4	1970-4	1971-1	1971-2	1971-3	1971-4
E	A	.9200	.8875	.7750	.6700	.6775	.6575	.5125	.5375	.6575	.6125
	P_1		.9001	.8935	.7176	.6339		.6711	.6258	.4892	.5957
	P_2		.9160	.8845	.7407	.6291		.6932	.5993	.5708	.6712
	N_1		.9200	.8875	.7750	.6700		.6575	.5125	.5375	.6575
	N_2		1.0992	1.1122	1.0724	1.0836		.9277	.9379	.8702	.8777
E/P	A	.0228	.0223	.0174	.0188	.0204	.0301	.0224	.0249	.0283	.0241
	P_2		.0216	.0198	.0125	.0132		.0296	.0257	.0200	.0231
	N_1		.0228	.0223	.0174	.0188		.0301	.0224	.0249	.0283
	N_2		.0226	.0225	.0225	.0227		.0327	.0332	.0320	.0324
D	A	.5500	.5500	.5500	.5500	.5500	.4500	.3000	.3000	.3000	.3000
	P_2		.5466	.5458	.5442	.5390		.4357	.3075	.2692	.2783
	N_1		.5500	.5500	.5500	.5500		.4500	.3000	.3000	.3000
	N_2		.5641	.5660	.5651	.5669		.3667	.3634	.3476	.3438

		General Foods					International Harvester				
E	A	.5900	.5950	.5850	.5850	.5825	.5625	.4800	.2725	.2775	.2900
	P_1		.5993	.6045	.5777	.5780		.5448	.5059	.0783	.2840
	P_2		.5973	.6015	.5926	.5935		.5414	.4498	.0770	.1603
	N_1		.5900	.5950	.5850	.5850		.5625	.4800	.2725	.2775
	N_2		.5824	.5885	.5954	.6015		.8206	.8286	.7504	.7554
E/P	A	.0152	.0136	.0140	.0157	.0171	.0242	.0175	.0099	.0100	.0102
	P_2		.0139	.0131	.0119	.0127		.0244	.0180	.0134	.0117
	N_1		.0152	.0136	.0140	.0157		.0242	.0175	.0099	.0100
	N_2		.0151	.0152	.0152	.0154		.0246	.0249	.0230	.0231
D	A	.3250	.3500	.3500	.3500	.3500	.4500	.4500	.4500	.3500	.3500
	P_2		.3292	.3520	.3521	.3521		.4438	.4445	.4240	.4343
	N_1		.3250	.3500	.3500	.3500		.4500	.4500	.4500	.3500
	N_2		.3409	.3445	.3494	.3531		.4954	.5010	.4973	.5024

TABLE 4 (continued)

		Johns-Manville					Owens-Illinois				
		1970-4	1971-1	1971-2	1971-3	1971-4	1970-4	1971-1	1971-2	1971 3	1971-4
E	A	.5425	.5050	.5650	.5725	.5950	.9925	1.0000	.9600	.9750	.9900
	P_1		.5307	.5206	.6263	.6299		.9976	1.1036	.9968	.9971
	P_2		.5615	.5308	.5819	.5903		1.0080	1.0151	.9885	1.0039
	N_1		.5425	.5050	.5660	.5725		.9925	1.0000	.9600	.9750
	N_2		.6429	.6509	.6377	.6450		.9899	1.0036	1.0140	1.0275
E/P	A	.0153	.0125	.0133	.0148	.0151	.0207	.0175	.0158	.0179	.0190
	P_2		.0123	.0106	.0153	.0160		.0204	.0193	.0123	.0137
	N_1		.0153	.0125	.0133	.0148		.0207	.0175	.0158	.0179
	N_2		.0196	.0198	.0186	.0187		.0159	.0161	.0163	.0164
D	A	.3000	.3000	.3000	.3000	.3000	.3400	.3400	.3400	.3400	.3400
	P_2		.2929	.2944	.3040	.3040		.3409	.3376	.3394	.3398
	N_1		.3000	.3000	.3000	.3000		.3400	.3400	.3400	.3400
	N_2		.3003	.3019	.3032	.3048		.3503	.3514	.3504	.3514

		United States Steel					Union-Carbide				
E	A	.8050	.6800	.7025	.8825	.6800	.6750	.6675	.6725	.6650	.6300
	P_1		.8416	.7666	.7009	.8167		.6629	.7097	.7260	.7246
	P_2		.8556	.7487	.7353	.8877		.6659	.6582	.6642	.6561
	N_1		.8050	.6800	.7025	.8825		.6750	.6675	.6725	.6650
	N_2		1.0690	1.0758	1.0096	1.0137		.8011	.8044	.7823	.7848
E/P	A	.0249	.0209	.0213	.0267	.0230	.0177	.0168	.0148	.0143	.0145
	P_2		.0228	.0182	.0200	.0229		.0170	.0151	.0110	.0113
	N_1		.0249	.0209	.0213	.0267		.0177	.0168	.0148	.0143
	N_2		.0295	.0299	.0288	.0292		.0193	.1095	.0190	.0193
D	A	.6000	.6000	.6000	.6000	.4000	.5000	.5000	.5000	.5000	.5000
	P_2		.5884	.5525	.5896	.6252		.4980	.4968	.4976	.4977
	N_1		.6000	.6000	.6000	.6000		.5000	.5000	.5000	.5000
	N_2		.5428	.5408	.5499	.5483		.5172	.5190	.5174	.5191

TABLE 4 (continued)

		United Aircraft					Woolworth				
		1970-4	1971-1	1971-2	1971-3	1971-4	1970-4	1971-1	1971-2	1971-3	1971-4
E	A	.8250	.9350	.9475	.7825	.7300	.5575	.6300	.6225	.6175	.6200
	P_1		.7691	.9090	1.1503	1.0145		.5202	.5505	.6556	.6549
	P_2		.7500	.8649	.9272	.7626		.5779	.6412	.6432	.6419
	N_1		.8250	.9350	.9475	.7825		.5575	.6300	.6225	.6175
	N_2		1.3765	1.4048	1.3471	1.3723		.6829	.6948	.6946	.7060
E/P	A	.0226	.0277	.0239	.0214	.0239	.0167	.0173	.0119	.0129	.0127
	P_2		.0252	.0290	.0196	.0189		.0128	.0132	.0110	.0115
	N_1		.0226	.0277	.0239	.0214		.0167	.0173	.0119	.0129
	N_2		.0236	.0239	.0247	.0251		.0227	.0230	.0218	.0220
D	A	.4500	.4500	.4500	.4500	4500	.3000	.3000	.3000	.3000	.3000
	P_2		.4362	.4408	.4508	.4490		.3007	.3008	.3019	.3020
	N_1		.4500	.4500	.4500	.4500		.3000	.3000	.3000	.3000
	N_2		.4634	.4675	.4687	.4728		.2954	.2978	.3008	.3032

Note: A = Actual value
P_1 = First-stage prediction
P_2 = Second-stage prediction
N_1 = Naive I prediction
N_2 = Naive II prediction

Predictions for 1971-1 and 1971-2 are based on parameter estimates for 1961-2 through 1970. Predictions for 1971-3 and 1971-4 are based on parameter estimated for 1961-2 through 1971-2.

equation are quite close to the actual (normalized) values. Two exceptions are evident. International Harvester suffered a severe drop in earnings in 1971. This earnings deterioration was due to a 19 day strike and to the effects of the declining position of the dollar on international sales. These international sales represent a substantial portion of total company sales. Likewise, United Aircraft suffered a loss due to a twenty-three per cent cutback in government contracts and a $137 million writeoff for unproductive jet engine costs.

The results for the E/P estimates are very similar to the results of E discussed above. Also, the structural equation estimates for dividends are considered very good. Because of the constancy of dividends, this relationship is expected.

Ranking of Predictions

Along with the first- and second-stage predictions of E, E/P, and D, Table 4 presents predictions of two naive models. The first naive model (N_1) represents no change in value for the three endogenous variables, i.e., $N_{t+1} = N_t$. The second naive model (N_2) simply estimates E, E/P, and D by regressing these values on time, i.e., $N_{t+1} = a + b(t) + e$. The naive models are designed as guidelines to aid in the interpretation of the predictive ability of the HPR model. These naive predictions are compared to the HPR model predictions.

An ordinal ranking of the prediction methods for each equation is presented in Tables 5 and 6. Entries in the tables show the number of times the model listed vertically is superior to the model listed horizontally for each equation. While Table 5 considers the predictions for both one and two quarters into the future, Table 6 considers only one quarter predictions. The predictions for both prediction time-periods are aggregated in each table.

In analyzing the rankings, several results are noteworthy. The structural equation outperformed[82] the first-stage equation for E twenty-five out of forty times for the ten firms in the two-quarter predictions. The P_2 performance advantage remained for the one-quarter predictions. The performance of P_2 with regard to N_1 improved when only one-quarter predictions were considered for E.

Although a similar pattern to that for E exists for the E/P ratio, P_2 is not superior to N_1 in either the two-quarter or one-quarter cases. However, for both the two-quarter rankings and the one-quarter rankings, P_2 strongly dominated N_2. The strong competition provided by N_1 is not unexpected in that the two samples of stocks are comprised of strong, stable performers.

The dividend predictions for both time intervals are clearly dominated by N_1. Again, because all firms utilize constant dollar dividends, this result

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[82] Performance is measured by the closeness of the absolute prediction error, i.e., $|A_j - P_j|$, where A_j = actual value and P_j = predicted value.

TABLE 5

PREDICTIVE COMPARISONS

Combined One and Two Quarter Predictions

Earnings

	P_1	P_2	N_1	N_2
P_1		15	13	36
P_2	25		19	37
N_1	27	21		37
N_2	4	3	3	

Total Predictions: 40

E/P Ratios

	P_2	N_1	N_2
P_2		15	27
N_1	25		29
N_2	13	11	

Total Predictions: 40

Dividends

	P_2	N_1	N_2
P_2		3(2)	31(26)
N_1	37(17)		37(27)
N_2	9(4)	3	

Total Predictions: 40

TABLE 6

PREDICTIVE COMPARISONS

One Quarter Predictions

Earnings

	P_1	P_2	N_1	N_2
P_1		8	8	18
P_2	12		12	19
N_1	12	8		18
N_2	2	1	2	

Total Predictions: 20

E/P Ratios

	P_2	N_1	N_2
P_2		9	13
N_1	11		13
N_2	7	7	

Total Predictions: 20

Dividends

	P_2	N_1	N_2
P_2		3(2)	13
N_1	17(5)		18
N_2	7	2	

Total Predictions: 20

is expected. In fairness to the P_2 estimates, however, rounding to the nearest dollar diminished the superiority of N_1 dramatically. These rankings are listed in the parentheses within the dividend portion of Tables 5 and 6. As with the above equations, P_2 appears to do at least as well as the other predictors for one quarter predictions.

Prediction Error

The amount of prediction error is evaluated in two ways. First, the mean absolute error for each estimating procedure is calculated based on the one- and two-quarter predictions for all ten firms. For example, the mean absolute error of the P_1 prediction of E is based on twenty P_1 predictions.

The second measure of prediction error is Theil's inequality coefficient.[83] This coefficient gives an index of predictive accuracy with a value of 0.0 being a perfect forecast, a value of 1.0 representing a no-change forecast, and values greater than 1.0 being worse than a no-change forecast. The coefficient is calculated by the following equation:

$$U = \left(\frac{\sum_i (P_i - A_i)^2}{\sum_i A_i^2} \right)^{\frac{1}{2}} \qquad (4\text{-}1)$$

where P_i = predicted change for the observation, i.e., $P_i = P_{t+1} - P_t$

A_i = actual change for ith observation, i.e., $A_i = A_{t+1} - A_t$

[83] Henri Theil, Applied Economic Forecasting (Amsterdam: North Holland, 1966), Chapter 2.

The inequality coefficient differs from the average absolute error in that the inequality coefficient considers the direction as well as the amount of error. The calculation of the inequality coefficient was also based on the combined one- and two-quarter predictions over all ten firms for each prediction method.

The inequality coefficients and the mean absolute error values are presented in Table 7. Although the results are mixed, several conclusions are indicated. Although N_1 has the lowest mean absolute error in two of three equations, N_1 has the largest inequality coefficient in all three cases. This result is expected in that the no-change forecast does not predict direction changes. In addition, the N_2 predictions perform poorest according to the mean absolute error in all cases. However, the inequality coefficients for N_2 are the lowest for both E/P and D. Finally, the P_2 predictions rank no worse than second in any of the six cases. Furthermore, the mean absolute error of P_2 is no worse than second when considering firms on an individual basis.

Stability of HPR Model

A primary criticism of previous single-equation valuation models has been the existence of extreme instability of the signs and size of the parameter coefficients. Therefore, the stability of the parameter coefficients of the HPR model is analyzed in two ways. First, the model is reestimated for two additional time intervals of equal length and the coefficients and signs are compared with the signs and coefficients of the initial specification period. Second, the the model is used to make predictions based on the parameter estimates for the

TABLE 7

MEASURES OF PREDICTION ERROR

Based on Predictions for 1971-1 and 1971-2

Structural Equation	Prediction Method	Theil's Inequality Coefficient	Mean Absolute Error
E	P_1	1.07	.0782
	P_2	1.01	.0684
	N_1	1.07	.0564
	N_2	1.03	.2339
E/P	P_2	1.11	.0028
	N_1	1.38	.0032
	N_2	1.04	.0054
D	P_2	1.36	.0148
	N_1	1.41	.0088
	N_2	.98	.0222

additional time periods. The results of these comparisons and predictions are now presented.

Comparison of Signs and Coefficients

The stability of the signs and parameter coefficients of any model is best tested under diverse conditions. Therefore, the HPR model was reestimated on the basis of thirty observations beginning in 1961-2 and continuing through 1968-3. This termination point represents the last full quarter before the Dow Jones Industrial Average reached a peak. A second reestimation of the HPR model concluded with the first quarter of 1970. This termination quarter immediately preceded a market trough according to the Dow Jones Industrial Averages. The second reestimation was also based on thirty-observations.

The use of equal-length time intervals for model reestimation has two purposes. First, a comparison of the model's predictive ability of peaks versus troughs is not biased with respect to specification observations. Second, the effects of additional specification observations can be evaluated by comparing the fit and predictions of the initial specification with the fit and predictions of the peak and trough reestimations.

The parameter estimates for the peak estimation, trough estimation and initial specification are presented in Tables 8, 9, and 10 for the earnings, earnings-price ratio, and dividend equations respectively. The initial specification is based on thirty-nine observations including both the peak and trough estimation periods.

TABLE 8

REGRESSION RESULTS: EARNINGS

$$E_{t+1} = a_0 + a_1\ GNP_{t+1} + a_2\ E_t + a_3\ D/E_t$$

Firm[1]	Prediction[2] Period	a_0	a_1	a_2	a_3	R_2
1	1968-3	.0171	.00020	.8483	-.0198	.9601
	1970-1	.5996	-.00013	.7587	-.4580	.9367
	1970-4	.1448	-.00004	.9231	-.0634	.9494
2	1968-3	-.0305	.00034	.7296	-.0073	.7469
	1970-1	.6895	.00018	.2927	-.5096	.8615
	1970-4	.2225	.00006	.7054	-.0824	.7513
3	1968-3	.1928	-.00001	1.0100	-.0178	.9973
	1970-1	.0372	.00005	.8770	-.0207	.9963
	1970-4	.0207	.00004	.9319	-.0153	.9978
4	1968-3	.2590	-.00019	.9387	-.1415	.9356
	1970-1	.3265	-.00005	.8058	-.2569	.9108
	1970-4	.2017	-.00004	.8719	-.1420	.9287
5	1968-3	.0972	.00019	.6469	-.1019	.9065
	1970-1	.0866	.00017	.6785	-.0842	.9212
	1970-4	.1943	.00012	.6347	-.1801	.9329
6	1968-3	.1383	.00005	.8325	-.1138	.8922
	1970-1	.2651	.00027	.6077	-.3479	.8888
	1970-4	.2629	.00025	.6046	-.3213	.9272
7	1968-3	.4803	.00038	.4235	-.3064	.7365
	1970-1	.6764	.00015	.4510	-.4237	.7477
	1970-4	.7664	.00007	.4065	-.4110	.6979
8	1968-3	.3488	-.00011	.8573	-.2640	.9348
	1970-1	.0093	-.00008	.9981	.0871	.9150
	1970-4	.1294	-.00003	.9216	-.0749	.9230
9	1968-3	-.2595	.00071	.7795	-.0385	.9771
	1970-1	.4292	-.00035	.9469	-.2012	.9641
	1970-4	.2951	-.00033	1.0100	-.0770	.9677
10	1968-3	.2309	.00014	.5391	-.1726	.9283
	1970-1	.3183	.00012	.4622	-.2268	.9215
	1970-3	-.0023	.00011	.8539	-.0172	.9236

[1]Firm Identification:

1 - American Can
2 - Bethlehem Steel
3 - General Food
4 - International Harvester
5 - Johns-Manville
6 - Owens-Illinois
7 - United States Steel
8 - Union Carbide
9 - United Aircraft
10 - Woolworth

[2]Prediction Period Identification:

1968-3: 30 observations: 1961-2 through 1968-3
1970-1: 30 observations: 1962-4 through 1970-1
1970-4: 39 observations: 1961-2 through 1970-4

TABLE 9

REGRESSION RESULTS: EARNINGS-PRICE RATIO

$$(E/P)_{t+1} = a_0 + a_1\ GNP_{t+2} + a_2\ NU_{t+1} + a_3\ MS_t + a_4\ AAA_t + a_5\ (D/E)_t + a_6\ \hat{E}_{t+1} + a_7\ (E/P)_t$$

Firm[1]	Prediction[2] Period	a_0	a_1	a_2	a_3	a_4	a_5	a_6	a_7	R^2
	1968-3	.02326	-.00002	-.00194	-.00001	.00258	.00098	.00726	.04488	.8499
1	1970-1	-.01380	-.00001	.00009	-.00012	.00420	.02280	.02567	.00288	.8440
	1970-4	.02260	-.00002	-.00171	.00002	.00297	-.00458	.00147	.17407	.8661
	1968-3	.03537	-.00002	-.00401	-.00007	.00328	.00028	.01519	.15006	.7509
2	1970-1	.02313	-.00001	-.00226	-.00017	.00482	.00340	.02337	.11054	.7607
	1970-4	.01385	.00001	-.00063	-.00015	.00383	-.00361	.01492	.15675	.8136
	1968-3	.01679	-.00002	-.00235	.00007	.00039	.00430	.00019	.36124	.8573
3	1970-1	.00208	-.00001	-.00090	.00007	-.00100	.00135	.01142	.57739	.8353
	1970-4	.00017	-.00004	-.00151	.00013	.00098	.00247	.03680	.42561	.8645
	1968-3	.05664	.00001	-.00173	-.00045	.00670	-.00658	.01422	.13132	.8341
4	1970-1	-.11661	-.00004	.00667	.00023	.00387	.04860	.04439	.88191	.8887
	1970-4	.03142	-.00001	-.00069	-.00025	.00692	-.00868	.01353	.11773	.7987
	1968-3	.05241	.00001	-.00356	-.00030	-.00003	.01123	.03076	.27965	.7556
5	1970-1	.01431	.00001	-.00145	-.00036	.00061	.03276	.07374	.42145	.6618
	1970-4	-.01303	-.00001	-.00036	-.00004	-.00055	.02216	.03887	.68436	.7033
	1968-3	.04341	-.00002	-.00326	-.00015	.00232	.01103	.01220	-.02709	.6085
6	1970-1	.02129	-.00002	-.00090	-.00014	.00337	.00878	.01894	.12973	.7091
	1970-4	-.00444	-.00003	-.00092	.00007	.00214	.01173	.01556	.61392	.7446

TABLE 9 (continued)

Firm[1]	Prediction[2] Period	a_0	a_1	a_2	a_3	a_4	a_5	a_6	a_7	R^2
	1968-3	-.00704	-.00002	-.00137	.00028	.00053	-.00452	-.00605	.58152	.8118
7	1970-1	.01670	.00005	.00253	-.00014	-.00016	-.02083	-.02651	.98696	.7490
	1970-4	.04374	.00002	-.00221	-.00015	.00050	-.00901	-.00991	.44726	.8115
	1968-3	.00253	-.00002	-.00267	-.00013	.00359	.02571	.02437	.36174	.8735
8	1970-1	-.01916	-.00002	-.00013	-.00011	.00502	.01916	.02645	.35059	.9072
	1970-4	.01021	-.00003	-.00231	.00001	.00356	.00476	.01228	.34608	.8824
	1968-3	-.06579	.00006	.00089	.00031	-.00458	.00536	-.01481	1.11448	.7675
9	1970-1	-.05717	-.00001	.00745	.00004	.00508	-.00634	.00457	.48658	.8861
	1970-4	-.01653	-.00002	-.00057	.00031	-.00048	-.00319	-.00544	.49312	.7576
	1968-3	.01449	-.00006	-.00282	-.00001	.00529	.00918	.04613	.35675	.9031
10	1970-1	.03711	-.00001	-.00245	-.00006	-.00098	-.00416	.00697	.48593	.7983
	1970-4	.01222	-.00002	-.00183	.00010	-.00038	-.00001	.01319	.54412	.8187

[1]Firm Identification:
1 - American Can
2 - Bethlehem Steel
3 - General Food
4 - International Harvester
5 - Johns-Manville
6 - Owens-Illinois
7 - United States Steel
8 - Union Carbide
9 - United Aircraft
10 - Woolworth

[2]Prediction Period Identification:
1968-3: 30 observations: 1961-2 through 1968-3
1970-1: 30 observations: 1962-4 through 1970-1
1970-4: 39 observations: 1961-2 through 1970-4

Earnings

As can be seen in Table 8, the signs among the prediction periods are very consistent for all firms. With regard to GNP, only three firms have deviations in signs among the three prediction periods. While all E coefficients have positive signs for all firms, only one firm has a deviation from consistent signs for the D/E variable.

Although some variation in parameter size is present, extreme differences occur in only a few cases. Because of the relative consistency of the R^2 values amongst the prediction periods, the variations in parameter size are not considered significant.

Earnings-Price Ratio

An analysis of Table 9 indicates that the macroeconomic variables had a higher inconsistency rate with regard to parameter signs than the microeconomic variables in the E/P equation. However, the money supply was the only variable that had sign deviations in more than fifty per cent of the firms. Of the six inconsistencies in the money supply sign, four occurred in the estimation over the complete time horizon. Thus the signs of the money supply variable were quite stable when comparing the two extremes, i.e., the peak and trough estimations. Similar situations occurred with the other macroeconomic variables.

Although the R^2 values are not as consistent as in the E equation, only three firms have R^2 deviations among the three prediction periods greater

TABLE 10

REGRESSION RESULTS: DIVIDENDS

$$D_{t+1} = a_0 + a_1 D_t + a_3 D/E_t + a_4 \hat{E}_{t+1}$$

Firm[1]	Prediction[2] Period	a_0	a_1	a_2	a_3	R^2
	1968-3	.2731	-.2171	.1842	.2889	.9158
1	1970-1	.3423	.3616	-.0722	.0466	.9276
	1970-4	.1616	.6990	-.0289	.0198	.9201
	1968-3	-.0828	.7197	.1170	.1674	.8597
2	1970-1	-.0868	.4853	.1786	.2485	.5187
	1970-4	-.0825	.7297	.1119	.1689	.8450
	1968-3	.1479	.7380	-.2551	.1609	.9629
3	1970-1	-.2747	-.5789	.4325	.9676	.9563
	1970-4	.5396	.2456	-.9170	-.8400	.9725
	1968-3	.0098	.8192	.0198	.0726	.9557
4	1970-1	-.0051	.8712	.0290	.0610	.9488
	1970-4	-.0037	.8907	.0209	.0550	.9659
	1968-3	.0470	.9077	-.0258	-.0148	.8763
5	1970-1	.0620	1.0870	-.0782	-.0797	.8893
	1970-4	.0023	.5821	.0720	.1435	.9337
	1968-3	.1140	.7521	-.0553	-.0060	.8948
6	1970-1	.1047	.7964	-.0525	-.0154	.8716
	1970-4	.1069	.8601	-.0758	-.0325	.9113
	1968-3	.1098	1.0353	-.1551	-.0352	.8220
7	1970-1	.2421	.8491	-.1788	-.0570	.6090
	1970-4	.5486	1.1927	-.4721	-.3850	.8482
	1968-3	.1776	.9213	-.1322	-.0705	.8876
8	1970-1	.1183	.9421	-.0786	-.0492	.8639
	1970-4	.0762	.9346	-.0441	-.0193	.9021
	1968-3	.1068	.4724	.0319	.0873	.9053
9	1970-1	.0512	.5174	.0694	.1113	.9441
	1970-4	.0411	.7999	.0104	.0383	.9440
	1968-3	.0160	.8913	.0074	.0140	.9161
10	1970-1	.0321	.8893	-.0030	.0007	.7966
	1970-4	.0102	.9648	-.0001	.0022	.9377

[1] Firm Identification:

1 - American Can
2 - Bethlehem Steel
3 - General Food
4 - International Harvester
5 - Johns-Manville
6 - Owens-Illinois
7 - United States Steel
8 - Union Carbide
9 - United Aircraft
10 - Woolworth

[2] Prediction Period Identification:

1968-3: 30 observations: 1961-2 through 1968-3
1970-1: 30 observations: 1962-4 through 1970-1
1970-4: 39 observations: 1961-2 through 1970-4

than .10. This greater variation in R^2 values is reflected in the increased variation in parameter size among the three prediction periods. Because of the volatility of E/P ratios, the variation in parameter size is not unexpected.

Dividends

Comparing the signs of the dividend equation in Table 10 yields results very similar to the E and E/P equations. The D variable had two sign inconsistencies, both occurring in extreme years. Three out of four D/E inconsistencies involved extreme periods, while neither of the two E sign inconsistencies involved extreme prediction periods. Again, only three of the ten firms had R^2 deviations greater than .10, an indication of the relative stability of parameter size.

With regard to the entire HPR model, large disparities in parameter size and sign are minimal. This result further supports the simultaneous equation, macroeconomic nature of the HPR model.

Peak and Trough Predictions

As discussed earlier, prediction-beyond-the-specification-data is perhaps the most critical test of any model. Furthermore, prediction of an identifiable change is even more demanding. Evaluation of the HPR model would not be complete without predicting the peak and trough turning points. The model estimation through 1968-3 was used to predict both the market peak quarter of 1968-4 and the first quarter of 1969. Likewise, the model estimation through 1970-1 was used to predict the market trough quarter of 1970-2 and the following quarters. In each case, one- and two-quarter predictions were made for each firm and are presented in Table 11.

The predictions are close to the actual values for all firms. Because the firm turning points do not necessarily coincide with the market turning points, the ability of the model to predict turning points based on these results may be overstated.

As with predictions from the initial specification, the predictions of the two turning points are also compared with two naive models. The first naive model (N_1) represents no-change, while the second naive model (N_2) is a linear trend prediction over time. These same naive models were used in Table 4 above.

An ordinal ranking of the structural equation (P_2) predictions and the predictions of the two naive models is presented in Tables 12 and 13. Rankings based on one- and two-quarter predictions for the combined peak and trough periods are presented in Table 12. The P_2 predictions perform[84] as well as the N_1 predictions in the E equation. P_2 is inferior to the N_1 predictions for the E/P ratio and superior to the N_2 predictions. Although the dividend predictions were rounded to the nearest penny for ranking, N_1 was superior to both P_2 and N_2. However, P_2 predicted both dividend changes during the time intervals.

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[84] Performance is measured by the closeness of the absolute prediction error.

TABLE 11

PREDICTION OF PEAK AND TROUGH TURNING POINTS

	American Can	1968-3	Peak 1968-4	1969-1	1970-1	Trough 1970-2	1970-3
	A	1.0250	1.0825	1.0625	.8700	.8900	.9050
	P_2		1.0513	1.1042		.8426	.8630
E	N_1		1.0250	1.0825		.8700	.8900
	N_2		1.0807	1.0990		1.1314	1.1479
	A	.0204	.0220	.0186	.0213	.0222	.0251
	P_2		.0210	.0202		.0212	.0195
E/P	N_1		.0204	.0220		.0213	.0222
	N_2		.0204	.0206		.0216	.0218
	A	.5500	.5500	.5500	.5500	.5500	.5500
	P_2		.5527	.5605		.5350	.5318
D	N_1		.5500	.5500		.5500	.5500
	N_2		.5543	.5566		.5664	.5689
	Bethlehem Steel						
	A	.8800	.8775	.9125	.8900	.8625	.7775
	P_2		.9107	.9152		.8711	.8566
E	N_1		.8800	.8775		.8900	.8625
	N_2		.9088	.9230		.9641	.9782
	A	.0293	.0281	.0291	.0328	.0303	.0351
	P_2		.0306	.0300		.0340	.0349
E/P	N_1		.0293	.0281		.0328	.0303
	N_2		.0286	.0291		.0311	.0316
	A	.4000	.4000	.4000	.4500	.4500	.4500
	P_2		.4136	.4312		.4599	.4803
D	N_1		.4000	.4000		.4500	.4500
	N_2		.3168	.3093		.4033	.4036

TABLE 11 (continued)

	General Foods	1968-3	Peak 1968-4	1969-1	1970-1	Trough 1970-2	1970-3
E	A	.5150	.5175	.5200	.5575	.5725	.5825
	P_2		.5195	.5219		.5642	.5782
	N_1		.5150	.5175		.5575	.5725
	N_2		.5299	.5361		.5573	.5630
E/P	A	.0115	.0121	.0128	.0134	.0135	.0158
	P_2		.0131	.0126		.0130	.0125
	N_1		.0115	.0121		.0134	.0135
	N_2		.0143	.0145		.0146	.0148
D	A	.3000	.3000	.3250	.3250	.3250	.3250
	P_2		.0131	.0126		.0130	.0125
	N_1		.3000	.3000		.3250	.3250
	N_2		.3106	.3143		.3328	.3365
	International Harvester						
E	A	.6500	.6300	.6725	.5750	.6050	.5900
	P_2		.6011	.5757		.5395	.5782
	N_1		.6500	.6300		.5750	.6050
	N_2		.9951	1.0159		.8037	.8087
E/P	A	.0202	.0176	.0181	.0232	.0211	.0257
	P_2		.0206	.0177		.0272	.0333
	N_1		.0202	.0176		.0232	.0211
	N_2		.0249	.0253		.0230	.0231
D	A	.4500	.4500	.4500	.4500	.4500	.4500
	P_2		.4385	.4407		.4408	.4439
	N_1		.4500	.4500		.4500	.4500
	N_2		.4750	.4821		.4982	.5048

TABLE 11 (continued)

	Johns-Manville	1968-3	Peak 1968-4	1969-1	1970-1	Trough 1970-2	1970-3
E	A	.5525	.5825	.5975	.6275	.6125	.5775
	P_2		.5697	.5951		.6383	.6288
	N_1		.5525	.5825		.6275	.6125
	N_2		.5698	.5779		.6436	.6530
E/P	A	.0172	.0155	.0137	.0209	.0179	.0188
	P_2		.0175	.0164		.0194	.0171
	N_1		.0172	.0155		.0209	.0179
	N_2		.0208	.0210		.0188	.0189
D	A	.2750	.2750	.3000	.3000	.3000	.3000
	P_2		.2758	.2789		.2986	.2961
	N_1		.2750	.2750		.3000	.3000
	N_2		.2786	.2798		.2985	.3004
	Owens-Illinois						
E	A	.7025	.7950	.7725	1.0175	.9875	.9950
	P_2		.7136	.7980		1.0252	1.0059
	N_1		.7025	.7950		1.0175	.9875
	N_2		.8208	.8320		.9574	.9723
E/P	A	.0117	.0114	.0108	.0164	.0181	.0234
	P_2		.0132	.0119		.0150	.0132
	N_1		.0117	.0114		.0164	.0181
	N_2		.0134	.0139		.0136	.0136
D	A	.3400	.3400	.3400	.3400	.3400	.3400
	P_2		.3387	.3412		.3431	.3441
	N_1		.3400	.3400		.3400	.3400
	N_2		.3483	.3498		.3506	.3519

TABLE 11 (continued)

	United States Steel	1968-3	Peak 1968-4	1969-1	1970-1	Trough 1970-2	1970-3
E	A	1.2050	1.1900	1.1725	1.0025	.9325	.8675
	P_2		1.1780	1.1717		1.0227	.9736
	N_1		1.2050	1.1900		1.0025	.9325
	N_2		1.1109	1.1232		1.1373	1.1486
E/P	A	.0302	.0277	.0273	.0297	.0249	.0278
	P_2		.0300	.0282		.0301	.0264
	N_1		.0302	.0277		.0297	.0249
	N_2		.0277	.0283		.0288	.0293
D	A	.6000	.6000	.6000	.6000	.6000	.6000
	P_2		.6106	.6075		.5815	.5757
	N_1		.6000	.6000		.6000	.6000
	N_2		.4892	.4834		.5978	.6010
	Union Carbide						
E	A	.6750	.6800	.6500	.7475	.7350	.7025
	P_2		.6390	.6428		.7353	.7231
	N_1		.6750	.6800		.7475	.7350
	N_2		.8954	.9051		.7923	.7942
E/P	A	.0161	.0157	.0144	.0202	.0198	.0207
	P_2		.0169	.0156		.0216	.0248
	N_1		.0161	.0157		.0202	.0198
	N_2		.0174	.0176		.0181	.0183
D	A	.5000	.5000	.5000	.5000	.5000	.5000
	P_2		.4958	.4942		.4994	.4952
	N_1		.5000	.5000		.5000	.5000
	N_2		.5138	.5163		.5176	.5198

TABLE 11 (continued)

	United Aircraft	1968-3	Peak 1968-4	1969-1	1970-1	Trough 1970-2	1970-3
E	A	1.3575	1.3750	1.2750	1.0525	.8775	.8875
	P_2		1.4110	1.4378		1.0006	.8145
	N_1		1.3575	1.3750		1.0525	.8775
	N_2		1.3393	1.3805		1.4435	1.4775
E/P	A	.0211	.0218	.0194	.0268	.0244	.0345
	P_2		.0227	.0254		.0285	.0323
	N_1		.0211	.0218		.0268	.0244
	N_2		.0169	.0171		.0198	.0201
D	A	.4500	.4500	.4500	.4500	.4500	.4500
	P_2		.4541	.4600		.4155	.3922
	N_1		.4500	.4500		.4500	.4500
	N_2		.4168	.4205		.4636	.4688
	Woolworth						
E	A	.5725	.5675	.5725	.5800	.5750	.5700
	P_2		.5904	.5897		.5801	.5779
	N_1		.5725	.5675		.5800	.5750
	N_2		.6631	.6795		.6968	.7113
E/P	A	.0209	.0175	.0174	.0154	.0165	.0195
	P_2		.0253	.0207		.0141	.0117
	N_1		.0209	.0175		.0154	.0165
	N_2		.0262	.0268		.0235	.0239
D	A	.2500	.2500	.2500	.3000	.3000	.3000
	P_2		.2508	.2505		.2977	.2977
	N_1		.2500	.2500		.3000	.3000
	N_2		.2646	.2664		.2833	.2854

Note:

A = Actual Value
P_2 = Second-stage prediction
N_1 = Naive I prediction
N_2 = Naive II prediction

Predictions for 1968-4 and 1969-1 are based on parameter estimates for 1961-2 through 1968-3. Predictions for 1970-2 and 1970-3 are based on parameter estimates for 1962-4 through 1970-1.

TABLE 12

PREDICTIVE COMPARISONS

One and Two Quarter Predictions

Earnings

	P_2	N_1	N_2
P_2		20	32
N_1	20		36
N_2	8	4	

Total Predictions: 40

E/P Ratio

	P_2	N_1	N_2
P_2		12	23
N_1	28		25
N_2	17	15	

Total Predictions: 40

Dividends

	P_2	N_1	N_2
P_2		1	30
N_1	12		32
N_2	3	2	

Total Predictions: 40

Values Rounded to Nearest Penny

Table 13 presents the ranking of one-quarter predictions for both the peak and trough. The results are similar to Table 12 with P_2 being superior to N_2 and no better than N_1.

Finally, Table 14 presents a comparison of peak rankings and trough rankings based on one-quarter predictions. The HPR model does not perform significantly different in predicting peak or trough turning points.

TABLE 13

PREDICTIVE COMPARISONS

One Quarter Predictions

Earnings

	P_2	N_1	N_2
P_2		10	15
N_1	10		16
N_2	5	4	

Total Predictions: 20

E/P Ratio

	P_2	N_1	N_2
P_2		4	12
N_1	16		12
N_2	8	8	

Total Predictions: 20

Dividend

	P_2	N_1	N_2
P_2		0	16
N_1	8		17
N_2	2	0	

Total Predictions: 20

Values Rounded to Nearest Penny

TABLE 14

PEAK VERSUS TROUGH PREDICTIONS

One Quarter Predictions

Earnings

Peak

	P_2	N_1	N_2
P_2		6	6
N_1	4		7
N_2	4	3	

Total Predictions: 10

Trough

	P_2	N_1	N_2
P_2		4	9
N_1	6		9
N_2	1	1	

Total Predictions: 10

Earnings-Price Ratio

Peak

	P_2	N_1	N_2
P_2		3	7
N_1	7		7
N_2	2	3	

Total Predictions: 10

Trough

	P_2	N_1	N_2
P_2		1	4
N_1	9		5
N_2	6	5	

Total Predictions: 10

Dividends

Peak

	P_2	N_1	N_2
P_2		0	9
N_1	3		9
N_2	0	0	

Total Predictions: 10

Trough

	P_2	N_1	N_2
P_2		0	6
N_1	5		8
N_2	2	0	

Total Predictions: 10

Values Rounded to Nearest Penny

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The prediction of future common stock values continues to be an intriguing and frustrating experience. Large amounts of time and financial resources have been exhausted in the search for the primary determinants of common stock prices. The efforts of researchers at dozens of academic institutions and a comparable number of private organizations have resulted in large improvements in the theoretical structure of share price models. However, the increased sophistication of the valuation models has not eliminated the statistical insignificance or instability of the greater majority of estimated parameter values. Furthermore, most valuation models do not recognize the overall macroeconomic environment in which corporations must perform.

This study has developed and evaluated an equity valuation model to predict the returns from holding a share of common stock a specified length of time. The model was designed to alleviate several problem areas that previous equity valuation models have not considered. First, the economic environment is recognized by considering both macroeconomic and microeconomic variables in the specification. Second, the independent variables are considered to be jointly determined as part of a general system of performance. This joint determinancy is achieved by utilizing a simultaneous system of equations.

Prior Treatment

Formal attempts at common stock valuation have progressed through three separate and distinct phases. Initial stock valuation procedures involved the analysis of past corporate performance to determine whether the common stock could be considered a good investment prospect. Because investors assumed that good past performance would continue into the future, the stock market became inflated and collapsed several times during the late nineteenth and early twentieth centuries. Thus, the first formal guidelines to equity valuation were set forth by Graham and Dodd.[85] These guidelines emphasized the future earning power of the firm and the regular and increasing payment of dividends.

The emphasis on future cash flows initiated the second phase of common stock valuation. The realization that future payments are worth less than current receipts led to the present value method of equity valuation. Most investors agreed that discounting the future cash flows by a rate that reflected the uncertainty of receiving the cash flows would yield the present value of the equity share. However, disagreement regarding the appropriate cash flows to be discounted and the correct discount rate soon developed.

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[85] Benjamin Graham and David L. Dodd, Security Analysis (2nd Ed., New York: McGraw-Hill Book Co., Inc., 1940), pp. 443–487.

Williams[86] and Gordon[87] agreed that the present value of a share of stock is found by discounting all future dividends. Thus the investor should only be concerned with the payments received. On the other hand, Lutz and Lutz[88] maintained that the investor purchases the income per share and the discounted value of this earnings stream should be considered as the true present value of a share of common stock.

The controversy over discounting earnings or dividends has been theoretically and mathematically resolved by Miller and Modigliani.[89] With a given capital expenditure program, Miller and Modigliani have shown that the earning power of the firm's assets determines the value of equity shares. Miller and Modigliani conclude that the manner of earnings distribution is totally irrelevant.

The appropriate discount rate considers the opportunity cost of riskfree assets as well as the uncertainty of risky cash flows. Difficulty in the measurement of this discount rate as well as the estimation of future cash flows led to the final phase of equity valuation. Rather than determine the present value of

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[86] John Burr Williams, The Theory of Investment Value (Cambridge, Mass.: Harvard University Press, 1938). Reprinted by North-Holland Publishing Company, Amsterdam in 1964.

[87] Myron J. Gordon, "Dividends, Earnings, and Stock Prices," Review of Economics and Statistics, XXXXI (May, 1959), pp. 96-105.

[88] Frederick Lutz and Vera Lutz, The Theory of Investment of the Firm (Princeton University Press, 1951).

[89] Merton H. Miller and Franco Modigliani, "Dividend Policy, Growth, and the Valuation of Shares," Journal of Business, XXXIV (October, 1961), pp. 411-431.

a share of stock, most empirical studies have attempted to determine the effects given changes in the stream of future cash flows and the degree of uncertainty surrounding the cash flows has on a share's value. Most of these empirical investigations have been multiple regression studies with some variation of earnings, dividends, and/or risk as the independent variables.

Cragg and Malkiel found the price-earnings multiple to be a linear function of the long term growth rate and the dividend payout.[90] Other cross-sectional studies have included the degree of risk as measured by the variance of past returns or the conformance of a given stock's return to the return of the market. Besides using dividends and the expected growth in dividends, Gordon considered earnings instability, leverage, and firm size as proxies for the uncertainty of future returns.[91]

Although the sophistication of these models has increased, statistical estimation has revealed that the parameter signs and magnitudes are quite unstable. Because of these inconsistencies, no consensus has been reached regarding the optimal specification structure of empirical valuation models.

Stock Valuation Model

The valuation model developed and evaluated in this study attempts to predict the return from holding a share of stock a specified length of time.

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[90] Burton G. Malkiel and John G. Cragg, "Expectations and the Structure of Share Prices," The American Economic Review, IX (September, 1970), pp. 601-17.

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

Because the returns may come from either dividends or price appreciation, these values are predicted for the specified holding period.

Although the prediction of dividends is a direct procedure, the prediction of any price appreciation or depreciation is accomplished in two separate steps. First, the earnings for the holding period are estimated. Second, the earnings-price ratio is estimated. Division of estimated earnings by the estimated earnings-price ratio will yield a predicted price for the specific holding period.

Along with the holding-period return (HPR) identity, the three structural equations used in the prediction of earnings, earnings-price ratios, and dividends are now presented in functional form.

1) $E(E^s_{t+1}) = f(GNP_{t+1}, E^s_t, (D/E)^s_t)$

2) $E(E/P)^s_{t+1} = g(GNP_{t+2}, NU_{t+1}, MS_t, AAA_t, (D/E)^s_t, \hat{E}^s_{t+1}, (E/P)^s_t)$

3) $E(D^s_{t+1}) = h(D^s_t, (D/E)^s_t, \hat{E}^s_{t+1})$

4) $E(HPR^s_{t+1}) = \dfrac{E(P^s_{t+1}) + E(D^s_{t+1})}{P^s_t}$

where, E/P is the earnings-price ratio,

D is dividend per share,

E is normalized earnings per share,

D/E is dividend payout,

HPR_{t+1} is next holding period return,

$t+1$ is subscript denoting the end of the holding period,

GNP is gross national product,

NU is unemployment rate,

MS is money supply,

AAA is corporate bond interest rate.

As stated above, the model integrates the macroeconomic environment with the microeconomic variables of the firm.

Because the HPR model is overidentified, estimates of the values for D^{S}_{t+1}, E^{S}_{t+1}, and $(E/P)^{S}_{t+1}$ for each firm are obtained by using a two-stage least squares approach (2SLS). As well as recognizing the interdependencies among the variables, the use of 2SLS provides consistent estimates of the various parameters in all equations. Thus the use of the endogenous variable E^{S}_{t+1} as an explanatory variable leads to consistent parameter estimation for the prediction of the earnings multiple, $E(E/P)^{S}_{t+1}$.

By regressing E^{S}_{t+1} on all exogenous variables, the first stage regression yields estimates of E^{S}_{t+1}, denoted by $\hat{E}^{S}_{t+1}$, which are used in equations 2 and 3 above. The endogenous variables are then estimated with second stage regressions. Although the HPR is easily determined by use of the identity, equation 4 above, the procedure in this study is to simply state the estimating results for the three structural equations.

Evaluation Sample

The HPR model was specified on a sample of five stocks chosen from the Dow Jones Industrials. Following specification, the model was tested and evaluated on an additional sample of five stocks chosen from the same source. The stocks chosen represented a wide range of industries.

The observations included the time period from 1960 through 1971. All observations were quarterly with the dividend and earnings values being allocated to the quarter in which generation took place. The affects of seasonal and irregular fluctuations in earnings were minimized by using a four-quarter moving average to normalize earnings.

Analysis and Evaluation

The HPR model was evaluated in several different ways. First, the goodness-of-fit of the first and second stage equations was analyzed by the coefficient of determination (R^2). Second, predictions of the endogenous variables beyond the specification observations were compared with the actual variables and predictions from two naive models. Furthermore, the predictive ability of the model was evaluated by comparing Theil's inequality coefficient with the mean absolute error of the predictions. Third, the stability of the model was evaluated by comparing the parameter signs and magnitudes as generated by model estimation for three distinct time periods: (1) the original specification period; (2) a thirty-observation period ending with the quarter preceding the market peak of 1968-4; and (3) a thirty-observation period terminating with the quarter preceding the market trough of 1970-2. Finally, predictions of the peak and trough turning points were made and compared with the actual values and predictions from two naive models.

Conclusions

Fit of the Model

The structural equations of the HPR model yielded high R^2 values for all ten sample firms. This result is explicative of several of the characteristics of the model. First, the integration of macroeconomic with microeconomic variables does indeed aid in the explanation of corporate performance variables. Although not attempting stock valuation, Elliott also found that macroeconomic variables aided in the prediction of firm financial variables.[92] Furthermore, as in Elliott's study, the use of a simultaneous system of equations does recognize the interdependencies among the various explanatory variables. Lower R^2 values were obtained by substituting a lagged value for the endogenous explanatory earnings variable. Finally, because the R^2 values for the second-stage equations are not significantly worse than obtained in the first-stage, serious specification errors do not seem to be present.

The goodness-of-fit of the model is further supported by the predictions of the variables beyond the specification data. The structural equations outperform the first-stage predictions and perform at least as well as the predictions of the best naive model. In particular, the model predicted two of three changes in the dividend payment that occurred during the prediction period.

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[92] J. Walter Elliott, "Forecasting and Analysis of Corporate Financial Performance with an Econometric Model of the Firm," Journal of Financial and Quantitative Analysis, VII (March, 1972), pp. 1499-1526.

Again, the good predictive ability of the model is attributed to the simultaneous system of equations and the recognition of the economic environment by utilizing macroeconomic variables.

The predictive ability of the model was finally evaluated by comparing the Henri Theil inequality coefficient with the mean absolute forecast error of the predictions. Both values were calculated from the combined predictions over all ten firms for each method of estimation. The structural equations predictions were consistently superior to the predictions of the naive models.

Stability of the Model

A prime criticism of past valuation models has been the instability of parameter signs and magnitudes. Thus the stability of the HPR model was evaluated in two ways. First, a direct evaluation of the estimated parameter signs and magnitudes was performed. The model was reestimated for two different time periods within the initial specification time horizon. Both reestimation time intervals included only thirty observations. The signs and magnitudes of the estimated coefficients for these reestimations were compared with the parameter estimations for the initial test period for all ten firms.

Among the three structural equations, less than thirty per cent of the parameters differed in sign for the three estimating periods. Extreme deviations in parameter magnitude were even more remote. Because the first reestimation ended one quarter prior to a market peak and the second reestimation concluded one quarter prior to a market trough, the stability of the parameter signs and magnitudes is considered to be very good.

The second measure of model stability involved the prediction of the endogenous variables for the market peak and market trough pertinent to the reestimation periods discussed above. These predictions were also compared to the predictions of two naive models. The structural equations perform at least as well as the best performing naive model. Again, both dividend changes during the prediction period are recognized by the model. Finally, the HPR model exhibited no significant difference in predicting peak turning points or trough turning points.

Implications

The purpose of this study was to develop an equity valuation model utilizing both macroeconomic and microeconomic variables and considering the interdependencies among the variables. Furthermore, the simultaneous equation, macroeconomic model was to be evaluated to determine whether the model is stable with regard to parameter estimation and whether the model contained any predictive ability.

The conclusions of this study agree with those of Elliott[93] in that both studies emphasize the importance of using macroeconomic variables in a simultaneous equation model for the prediction of firm financial variables. However, whereas Elliott predicted firm cash flows, this study has attempted to predict the distribution and investor evaluation of corporate cash flows, i.e., earnings, dividends, and earnings-price ratios.

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[93] Elliott, "Forecasting and Analysis," pp. 1513-1524.

This dissertation has revealed several areas in which additional research is needed to more fully understand the predictive ability of simultaneous-equation valuation models. For example, when sufficient data is available, the use of GNP as predicted by other simultaneous-equation models may further improve the influence of the macroeconomic variables. Also, the inclusion of a risk proxy in preliminary investigations in this study resulted in significant deterioration of the model's overall fit. Thus, the treatment of risk in time-series models is quite different from cross-sectional models and should be more fully evaluated. The evaluation of more sophisticated techniques of earnings normalization may be beneficial. For example, a comparison of various distributed lag models, exponential smoothing models, etc., may have implications regarding smoothed data as well as using past data to predict future values. Finally, simultaneous-equation models may provide a vehicle for empirical study of many theoretical propositions now subject only to partial tests through single-equation models. For example, identifying and evaluating the effects of a firm's cost-of-capital on the valuation of the corporation.

Although this study has dealt with the prediction of returns for individual equity shares, implications from a macroeconomic, portfolio standpoint do exist. An increasing proportion of equity shares is being held by various institutional investors. In view of the effect of current inflationary trends on pension funds and other retirement holdings of these institutional investors, a more comprehensive treatment and understanding of the valuation characteristics of corporate securities will contribute to the maintenance of common stocks as investment securities.

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