THE EFFECTS OF INFLATION, THE DEGREE OF LEVERAGING, AND ACCOUNTING PRACTICES UPON COMMON STOCK PRICES

Dissertation for the Degree of Ph. D.

MICHIGAN STATE UNIVERSITY
DUNCAN CAMERON BRYAN

1975

This is to certify that the

thesis entitled

THE EFFECTS OF INFLATION,
THE DEGREE OF LEVERAGING,
AND ACCOUNTING PRACTICES UPON COMMON STOCK PRICES

presented by

Duncan Cameron Bryan

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in FINANCE

Roland I. Robinson
Major professor

Date April 30, 1975

O-7639

ABSTRACT

THE EFFECTS OF INFLATION, THE DEGREE OF LEVERAGING, AND ACCOUNTING PRACTICES UPON COMMON STOCK PRICES

By

Duncan Cameron Bryan

This thesis analyzes the response of investors to the differential impact of inflation upon firms having differing degrees of leveraging and differing accounting practices. Investor response is measured by the relationship of common stock prices to historical-dollar earnings from which inflation-induced earnings have been abstracted.

In order to pursue this research, a model for true after-tax net nominal earnings (TANNE) was developed. TANNE are equal to historical-dollar earnings adjusted for earnings resulting from: a net-monetary debtor position, FIFO inventory valuation, and the underdepreciation of fixed assets when general price-level adjusted accounting is contrasted with historical-dollar accounting.

TANNE were incorporated within the framework of a new common stock valuation model, which includes not only characteristics of the individual firm, but also characteristics of the market as a whole. This model is an

extension of the works of John B. Williams and David Durand. The explanatory variables in the model include: the firm's current dividend, the firm's expected dividend growth rate, the firm's risk premium, the market's dividend yield, the market's expected dividend growth rate, and the market's risk premium.

In order to capture the impact of inflation tests were run on 1965 and 1972 data. 1965 was the final year of a six year period of relative price stability, while 1972 came at the end of a six year period in which the average annual rate of inflation was twice that of the prior period.

The major findings of this research are as follows.

The coefficients of the relative dividend payout ratio were negative in both of the test years, but significant only for 1972. These results indicate that investors prefer a lower relative dividend payout ratio or a higher relative earnings retention rate, in an inflationary period.

The coefficients for the FIFO inventory valuation holding gains were significant in both of the test years. However, in the relatively low inflation period the sign of the coefficient was positive and in the relatively high inflation period it was negative. These results indicate that in a period of relatively low inflation investors look favorably upon such gains, but in an inflationary period such gains are discounted by investors.

The coefficients of the net-monetary debtor leverage position were negative in both years, and significant only in the 1972 inflationary period. These results indicate that investors tended to ignore a net-monetary debtor position in a period of relative price stability. However, in an inflationary period, specifically 1972, investors viewed a net-monetary debtor leverage position as not enhancing the relative value of the firm's common stock. These results appear to be at variance with those of Professors R. Kessel and A. Alchian, but may be explained by the four-fold increase in the cost of servicing net-monetary debt per dollar of earnings.

The coefficients of the relative historical-dollar accounting earnings were positive and significant in both test years, indicating that investors look favorably upon a relative increase in historical-dollar earnings.

The coefficients of the proxy for the underdepreciation of fixed assets when general price-level adjusted accounting and historical-dollar accounting are contrasted were significant in the period of low inflation and not significant in the inflationary period. The individual values of the lagged coefficients were positive and significant for the most recent three years in both test periods. It would appear that investors looked favorably upon the underdepreciation of fixed assets. This apparent anomaly may have been caused by the inability to specify the replacement variable in the regression model. Thus these findings, rather than revealing investor perception of underdepreciation, may indicate that investors look favorably upon the most recent three year's general price-level adjusted capital spending.

The empirical results lend support to the hypothesis that investors were intuitively adjusting historical-dollar accounting earnings for the impact of inflation even before the artificiality of some of these earnings had been brought to general attention. In this way these findings support the efficiency of capital markets.

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By

Duncan Cameron Bryan

A DISSERTATION

Submitted to

Michigan State University

in partial fulfillment of the requirements

for the degree of

DOCTOR OF PHILOSOPHY

Department of Accounting and Finance

1975

ACKNOWLEDGEMENTS

I wish to thank those who have provided me with the inspiration and support necessary for the completion of this thesis.

I am grateful to Professor Roland I. Robinson for agreeing to serve as Chairman of my Thesis Committee, and for his insightful comments and advice on my work. Professor Harold Sollenberger, as well as serving on my committee, was a source of literary and professionsl help throughout this thesis. I am especially grateful to Professor Robert Rasche without whose enthusiasm and knowledge, my work would not have been completed.

I am indebted to Professor William Barnett who undertook to read this thesis, and whose comments were invaluable.

To my wife whose faith and editorial ability during a period of ever increasing adversity was a source of constant inspiration.

I humbly acknowledge that my wife and daughters gave several years of their husband and father to this work.

Finally I would thank Christine, Harvey and Mermum and all those others who have believed in the X factor.

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CHAPTER I

INTRODUCTION

A decade of accelerating inflation has made financial analysts deeply conscious of how the shrinking value of money effects the calculus of economic decision making. Investors are particularily sensitive to this problem because they must make a trade-off between certain consumption today and uncertain consumption in the future. Inflation has a variety of influences upon the value of corporate equities; some would appear to be favorable, while others appear to be unfavorable.

This study is an effort to sort out these presumptive influences and to bring to bear the powerful tools of statistical research upon these influences, and to give some quantitative measure of their relative importance.

This research was stimulated by still one more consideration. Security analysis depends in a large measure upon the financial reports prepared by accountants. During the past decade the accounting profession has been in an unusual period of flux as "generally accepted accounting principles" have been revised, disputed, and revised again. Investors have become more sensitive to the fact that accounting is not an exact science and presumably wish to look more deeply into the impact of inflation upon the "quality of earnings" as reported by the accountants.

This research will investigate investor perceptions of certain financial variables as determanents of common stock valuation during an inflationary period.

The primary area where inflation might be expected to affect this perception would be in current earnings relative to the previous year's earnings; a focus stimulated by investor emphasis upon growth in earnings per share. In addition, investor discrimination between the current dividend payout ratio as compared to the previous year's ratio deserves testing.

A second area where inflation might be expected to affect investor perception, is in the difference between real economic and accounting depreciation of fixed assets.

Another area where inflation might be expected to affect investor perception, is the earnings attributable to the first-in-first-out (FIFO) inventory valuation method.

Still another area where inflation might be expected to affect investor perception, is the degree to which a firm is a net-monetary debtor.

Still other areas where inflation might be expected to affect investor perception are the riskiness of the firm and its expected dividend growth rate.

In order that firm-size may not be a source of possible distortion, financial data for individual firms will be standardized by dividing these data by the previous year's earnings.

This study will require models for inventory holding gains, and for the underdepreciation of fixed assets when historical-dollar accounting is contrasted with general price-level adjusted accounting. Further, it will develop and specify a common stock valuation model that incorporates the firm's current dividend, the dividend yield for the market as a whole, the expected dividend growth rate of the firm relative to that of the market, and the risk premium of the firm relative to that of the market as a whole.

CHAPTER II

A REVIEW OF PAST STUDIES

The economic literature and more recently the finance and accounting literature have dealt with the potential wealth redistribution due to unanticipated inflation.

Economists have speculated that business firms gain from inflation. Kessel has summarized the three basic transmission hypotheses.[1]

First, based upon the hypothesis that debtors gain from inflation, and the assumption that business firms are debtors, then wealth will be transferred from creditors to debtor firms if the creditor's inflationary expectations are less than the actual rate of inflation. Firms contract to pay fixed sums of money in the form of debt instruments; inflation will cause a depreciation in the real value of money, i.e. its command over real resources. If this depreciation in the real value of money were not fully anticipated by creditors, when the nominal interest rate

1 Reuben Kessel, "Inflation Caused Wealth Redistribution: A test of a Hypothesis," American Economic Review, vol. 66 (March 1956), pp. 128-141.

on the debt was established, creditors would lose and debtor firms would gain.[2] Fisher took the position that wealth redistribution clearly took place through this debtor-creditor mechanism: "When prices are rising, the rate of interest tends to be high but not so high as it should be to compensate for the rise; and when prices are falling, the rate of interest tends to be low, but not so low as it should be to compensate for the fall".[3]

Second, based upon the assumption that nominal wages lag behind prices during an inflationary period, worker's real wages decline while business firms are in a position to raise prices. Thus firm's earnings would be relatively higher during periods of inflation and wealth would be transferred from wage earners to business firms.[4] However, serious doubt has been cast upon the validity of this hypothesis by the empirical studies of Alchian and Kessel,[5]

2 J.M. Keynes, Tract on Monetary Reform, London: MacMillan Co., 1923, p. 18.

3 I. Fisher, The Purchasing Power of Money, New York: MacMillan Co., 1920, pp. 58-73, 190-191.

4 E.J. Hamilton, "Prices as a Factor in Business Growth," Journal of Economic History, vol. XII, (Fall, 1962), pp. 325-349.

5 Armen Alchian, Reuben Kessel, "The Meaning and Validity of Inflation - Induced Lag of Real Wages Behind Prices," American Economic Review, vol. 50 (March, 1960), pp. 43-66.

Bach and Ando,[6] and Felix.[7]

Third, firms may increase real profits in an inflationary period due to inventory holding gains. This hypothesis assumes that inventories are sold at prices that reflect a mark-up based upon current prices rather than based upon historical costs.[8] However, there is no real gain or loss in terms of real resources as a consequence of inflation. As Kessel stated:

"Reported business profits may appear larger . . . . However, this is purely an artifact of the original cost accounting."[9]

The proposed study will not pursue the wage-lag hypothesis, but will concentrate on the debtor-creditor hypothesis and the apparent increase in nominal income due to inventory holding gains in an inflationary period.

6 G.L. Bach, A. Ando, "The Redistributional Effects of Inflation," Review of Economics and Statistics, vol. 37 (February, 1957), pp. 1-13.

7 D.E. Felix, "Profit Inflation and Industrial Growth," Quarterly Journal of Economics, vol. 70 (August, 1956), pp. 441-463.

8 J.M. Keynes, op.cit., pp. 18-19.

9 R. Kessel, op.cit., p. 129.

INFLATION AND A MONETARY DEBTOR POSITION

Bresciani-Turroni,[10] and Graham,[11] found that the real value of bank stocks declined during inflations, and that stock price indexes rose at most only about as much as the rise in price indexes. Kessel[12] attempted to evaluate the Keynes-Fisher hypothesis, that monetary debtors gain from inflation, in terms of stock price movements and to rationalize his findings with those of Bresciani-Turroni and Graham. Kessel used four random samples of industrial firms, each from those listed on the New York Stock Exchange, and one non-random sample of 16 firms in the banking industry. He classified firms as either net-monetary debtors or net-monetary creditors based upon whether their monetary liabilities were greater than their monetary assets. Monetary assets were defined as an asset whose market value is unaffected by changes in the level of prices. He included in monetary assets: cash, marketable securities, accounts receivable, tax refund receivable, notes receivable, prepaid insurance and gold. Marketable securities required the determination of the net-monetary position of each of the firms these securities represented.

10 Bresciani-Turroni, Economics of Inflation, London: MacMillan Co., 1937, pp. 253, 298.

11 F.D. Graham, Exchange Prices and Production in Hyper-Inflation: Germany 1920-23, Princeton, 1930, pp. 74, 177.

12 R. Kessel, op.cit.

In view of these difficulties he assumed that prior to 1930 these securities represented monetary assets and that after 1930 they were monetarily "neutral" - neither monetary assets nor monetary liabilities. Direct investments in other firms were considered monetarily "neutral". Monetary liabilities were defined as liabilities whose amount would be independent of changes in the level of prices. Monetary liabilities included: accounts payable, notes payable, tax liability reserves, bonds and preferred stock. Convertible and participating preferred stocks, while income dependent to some degree, were included as part of the monetary liabilities.

Using beginning of the period balance sheet data, Kessel found that the increase in the market price of the common stock of net-monetary debtor firms was greater than the increase in common stock price of net-monetary creditors in two overlapping inflationary periods: 1939-1948 and 1942-1948. Using the Mann and Whitney test for differences in random variables Kessel found an indicated difference at a level of significance of less than .0025.[13] Rank correlation testing was also used and yielded results which were significant at the .002 level ($R^2 = .47$). An additional test during a deflationary period 1929-1933 was made and as hypothesized, the market price of net-monetary creditor

13 Ibid., p. 135.

firms outperformed that of net-monetary debtor firms at significance levels of .054 and .03.[14]

The 16 banking firms were tested using rank correlation based upon the relative net-monetary creditor status, as all firms were found to be net creditors during the 1942-1948 period, and the relative percent increase in each firm's stock price. "Roughly 23 percent of the observed variation was explained by the debtor-creditor hypothesis."[15]

Kessel concluded that net-monetary debtor or creditor position had a significant impact upon stock prices in periods of both inflation and deflation, but Kessel questioned the Keynesian assumption that industrial firms were net-monetary debtors. He further concluded that since many industrial firms were not monetary debtors that any stock market index would be composed of both monetary debtors and creditors. The performance of the stock market index as compared to the price index would be a function of the percentage of net-monetary debtors comprising the stock market index, and thus, it might not reflect the change in price levels, thereby confirming the findings of Bresciani-Turroni and Graham.

14 Ibid., p. 137.

15 Ibid., p. 132.

De Alessi,[16] using data from a study by Alchian and Kessel,[17] and from a work by Broussalian,[18] found that in 1915 94 percent of the firms studied were net-monetary debtors; by 1934 this percentage had dropped to 54 percent and by 1952 the percentage was 57 percent. De Alessi's conclusion was that:

"Like any other economic unit, a business firm will gain from any unanticipated inflation only in proportion to its net debtor position and the evidence indicates that all business firms are not net debtors."[19]

Bach and Ando[20] analyzed a random sample of 52 firms over the 1939-1952 inflationary period. They performed rank correlation testing using net-monetary debtor or creditor rank and the increase in stock prices over three sub periods. Their highest rank correlation coefficient was .26 and Bach and Ando concluded that:

"These results do not confirm the prediction that debtor companies will gain more during inflation than

16 Louis de Alessi, "Do Businesses Gain From Inflation," Journal of Business, vol. 37 (April, 1964), pp. 159-166.

17 Armen A. Alchian, Reuben Kessel, "Redistribution of Wealth Through Inflation," Science, vol. 130 (Sept. 4, 1959), pp. 535-539.

18 V.A. Broussalian, "Unanticipated Inflation: A Test of the Debtor-Creditor Hypothesis," Unpublished Ph.D. dissertation, University of California, Los Angeles, 1961.

19 De Alessi, op.cit., p. 166.

20 Bach, Ando, op.cit., p. 9.

will creditors, for any of the sub periods shown, the results are mixed, and over all show no very significant differences."[21]

Alchian and Kessel[22] made a more comprehensive study of all industrial firms whose common stock was traded on the New York Stock Exchange at any time between 1914 and 1952. They incorporated in their study a new measure of net-monetary debtor or creditor status - the ratio of net-monetary debt to the market value of the firms' common stock. They employed a t test for differences between the means of the relative market value of debtor and creditor firms, adjusted for stock splits and dividends and assumed that all cash dividends were continuously reinvested in the firm. Their tests for various sub periods which included both inflation and deflation constitute in their words "overwhelming evidence in support of the Keynes-Fisher reasoning about the bias in interest rates during inflation."[23]

THE ACCURACY OF INFLATIONARY ANTICIPATION

De Alessi[24] constructed a model which is designed to measure the degree of accuracy with which inflation is

21 Ibid., p. 10

22 Alchian, Kessel, op.cit., p. 535.

23 Ibid., p. 539.

24 Louis de Alessi, "The Redistribution of Wealth by Inflation: An Empirical Test With U.K. data," Southern Economic Review, vol. 3 (October, 1963), pp. 113-127.

anticipated. The firm's monetary debtor position was established in a manner similiar to that of Kessel.[25]

$M_t \equiv ML_t - MA_t$ $\quad$ M_t = Net monetary debtor position.

ML_t = Monetary liabilities.

MA_t = Monetary assets.

He then defined net non-monetary position as the difference between non-monetary assets (land, buildings, inventory) and non-monetary liabilities (depreciation and maintenance).

$R_t \equiv NMA_t - NML_t$ $\quad$ R_t = Net non-monetary position, i.e. net real assets.

NMA_t = Net non-monetary assets.

NML_t = Net non-monetary liabilities.

Nominal wealth, W_t, was then defined as the difference between net non-monetary position (net real assets) and net-monetary debtor position.

$W_t \equiv R_t - M_t$

De Alessi then excludes all other wealth-affecting factors except "normal income under conditions of static equilibrium" so that net real assets, R_t, grow at some normal income rate, r, which is termed the real rate of interest. Net monetary liabilities, M_t, grow at the

25 R. Kessel, op.cit., p. 114.

contractually specified interest rate, m.[26]

De Alessi assumes that m = r.

Thus:

$$W_{t+1} - W_t = r(R_t) - m(M_t)$$

If all prices increase at some rate, K, per period then net real assets will grow at a rate of r+K per period and net-monetary liabilities will grow at a rate of $m+K_a$, where K_a was the anticipated rate of inflation at the time the monetary debts were contracted.

Then:

$$W_{t+1} - W_t = (r+K)(R_t)-(m+K_a)(M_t)$$

Through algebraic manipulation and substitution:

$$W_{t+1} - W_t = (r+K)W_t + B(K)(M_t) + U_t$$

Where:

$$B = \frac{K-K_a}{K}$$

U_t = an error term.

B = a variable denoting how well inflation has been anticipated.

B is restricted by de Alessi to be:

$$0 < B \leq 1$$ [27]

26 De Alessi, op.cit., p. 114.

27 Ibid., p. 116.

If:

$0 < B < 1$ Inflation has been partially anticipated.

$B = 0$ Inflation has been perfectly anticipated.

$B = 1$ There has been no anticipation of inflation.

De Alessi then makes his crucial assumption:

"The debtor-creditor hypothesis does not deny that factors other than inflation may effect wealth positions of firms or individuals during inflation. It does assert that, in a sample in which such factors are randomly distributed with respect to net-monetary position, a positive correlation will be found to exist during inflation between the net-monetary position of firms and relative changes in wealth."[28]

Thus all other phenomena that may effect wealth over time are assumed to be independent of net-monetary debtor status and are included in an error term, U_t.

Dividing through by, W_t, de Alessi obtains

$$\frac{W_{t+1}}{W_t} = r + \frac{I_{t+1}}{I_t} + B\left(\frac{I_{t+1}-I_t}{I_t}\right)\frac{M_t}{W_t} + U_t$$

I = An index of prices.

The variables are converted to units relative to their value at t = 0 and $\frac{M'}{W'}$ is an estimate of $\frac{M_t}{W_t}$ over the period.

28 Ibid., p. 116.

o to t is substituted in the model.

$$\frac{W_t}{W_o} = r + \frac{I_t}{I_o} + B\left(\frac{I_t - I_o}{I_o}\right) \frac{M'}{W'} + U_t$$

As an estimate of $\frac{W_t}{W_o}$ de Alessi uses the relative price changes in the market price per share of a firm's common stock $\frac{P_t}{P_o}$ adjusted for cash dividends and changes in the number of shares outstanding.

De Alessi's final regression model is:

$$\frac{P_t}{P_o} - \frac{I_t}{I_o} = r + B\left(\frac{I_t - I_o}{I_o}\right) \frac{M'}{W'} + U_t$$

De Alessi evaluated the null hypothesis, using United Kingdom data, that inflation was perfectly anticipated, (i.e. B = 0). His tests for levels of significance at which the null hypothesis could be rejected yielded mixed results. In only three out of 36 tests was the level of significance less than .05.[29]

While his other tests did not yield much more conclusive results de Alessi concluded:

"This study corroborates the results obtained by Professors Alchian and Kessel in the United States, and provides evidence to support the general applicability of the debtor-creditor hypothesis."[30]

29 *Ibid.*, p. 122.

30 *Ibid.*, p. 123.

De Alessis' construction of a formal model was a contribution; however, it appears to have been incompletely specified. Further, he attributes the lack of decisiveness to the possibility that his sample size may have been insufficient and that 40 percent of his sample population could have been affected by a non inflationary event that was not randomly distributed among the total sample population. The latter possibility was caused by the fact that 40 percent of his sample was restricted to firms in the breweries and distilleries industry (BD), and in his words, "a change in the relative price of beer would clearly affect the wealth of firms in the BD sample".[31]

In the next section a more complete model will be specified and the sample population of this study will not be as heavily concentrated in any one industry.

THE ADAPTIVE EXPECTATIONS MODEL

Prichard[32] built on the work of de Alessi. Prichard incorporated an adaptive expectations model for the expected rates of inflation into de Alessi's original model, which Prichard then called "the adaptive expectations-wealth redistribution model".[33] Using his model,

31 Ibid., p. 123.

32 Woodward C. Prichard, "Inflation, Expectations and Wealth Redistribution," Unpublished Ph.D. dissertation, Michigan State University, East Lansing, 1970.

33 Ibid., p. 86.

Prichard attempted to predict periods when wealth redistribution would or would not take place. In discussing his results Prichard stated, "these results do not support the predictive accuracy of the adaptive expectations-wealth redistribution model . . . the . . . model did not appear to be a good predictor of the periods in which significant wealth redistribution could be found".[34]

In reviewing the inconclusiveness of his results Prichard concludes that, "the rates of price level change may not have been great enough for wealth redistribution to show up in the testing". The period covered by his tests was 1949-1967. Finally Prichard states, "the wealth redistribution model itself may be inadequate. It may be necessary to use a complete multivariate model of changes in wealth. This would be a very large undertaking."[35]

INFLATION AND DEPRECIATION

Bach and Stephenson[36] in a recent journal article building upon the work of Kessel[37] classified firms as to their net debtor, creditor status. Their results indicate

34 Ibid., p. 92

35 Ibid., p. 95

36 G.L. Bach and James B. Stephenson, "Inflation and the Redistribution of Wealth," The Review of Economics and Statistics, vol. LVI (Feb., 1974), pp. 1-13.

37 Kessel, op.cit.

that for two inflationary sub periods, 1955-1957, and 1965-1970, the ratio of the increase in stock value for net creditor firms divided by the increase in stock value for net debtor firms was a standoff. The increase in median stock value for net creditor firms was only 63 percent of that for net debtor firms in the first sub period, while in the second sub period net creditor's median stock value was 191 percent of that of net debtors. In the third sub period of relative price stability, 1958-1964, as Bach and Stephenson expected, net creditors outperformed net debtors by 193 percent in median stock value.[38]

Bach and Stephenson incorporated a measure of the exposure to the loss a firm might undergo in a period of unanticipated inflation; this measure was the sum of the erosion of its net creditor position due to the actual inflation experienced during the period plus, "the monetary asset equivilent of the future tax savings resulting from depreciation deductions".[39]

The exposure to erosion on net creditor account, ENCA:

$ENCA = (MA-ML)K$ MA = Monetary assets.

ML = Monetary liabilities.

K = The actual rate of inflation.

38 Bach, Stephenson, <u>op.cit</u>., p. 9.

39 <u>Ibid</u>., p. 9.

The exposure on depreciation account, EDA:

$$EDA = FX(t)K \qquad FX = \text{Net fixed assets.}$$
$$t = \text{The tax rate.}$$
$$K = \text{The actual inflation.}$$

Net fixed assets times the tax rate is the future tax savings from future depreciation deductions. When multiplied by the rate of inflation a measure of the erosion of future tax savings due to inflation can be developed.

$$\text{Total exposure} = ENCA + EDA$$
$$= (MA-ML)K + FX(t)K$$

Bach and Stephenson define a positive exposure as one in which the firm's net creditor exposure is greater than its exposure on depreciation account. A negative exposure as one in which the net debtor exposure is greater than the exposure on depreciation account.

Positive exposure means: $(MA-ML + FX(t))K>0$

Negative exposure means: $(MA-ML + FX(t))K<0$ or,

Negative exposure means: $(ML-MA)>FX(t)$

As measured by the median increase in stock values positive exposure firms did 23 percent and 111 percent better than the negative exposure firms in the 1955-1957 and 1965-1970 inflationary periods, while in the 1958-1964 period of price stability positive exposure firms outperformed negative exposure firms by 148 percent using median stock values. While these values indicate a weak confirmation of the debtor-creditor hypothesis, it is believed that the stringency of the negative exposure criterion eliminated all but the strongest net debtor firms, and reclassified the less strong net debtor firms as positive exposure firms.[40]

INFLATION AND FINANCIAL ACCOUNTING

The inclusion of depreciation in a wealth redistribution model is significant because George Terborgh has estimated that 20 percent of reported corporate profits since World War II were "paper" profits due to under-depreciation of fixed assets in inflationary periods.[41]

Bach and Stephenson recognized "the overstatement of real profits because of inflation-induced increases in stated inventories", but did not include them "because satisfactory data were unavailable for individual firms".[42]

Rosenfeld[43] reviewed a field test in which 18 U.S. companies restated their financial reports for 1966 and

40 If a tax rate of 50 percent is assumed, to qualify as a negative exposure firm the firm's net monetary debtor position must be at least 50 percent of the firm's net fixed assets. This criterion would lead one to expect a substantial reduction in the impact of net debtor firms in any test. While 89 percent of the firms were net debtor firms in their initial tests, only 30 percent of the firms analyzed by positive and negative exposure were negative, i.e. very strongly net debtor.

41 George Terborgh, Essays in Inflation, Washington, Machinery and Allied Products Institute, 1971, pp. 53-54.

42 Bach, Stephenson, op.cit., p. 7.

43 Paul Rosenfeld, "Accounting For Inflation: A Field Test," Journal of Accountancy, (June, 1969), pp. 45-50.

1967 on the basis of "general price level accounting". The impetus for this test may be found in the minutes of the Accounting Principles Board, April 28, 1961; "the assumption in accounting that fluctuations in the value of the dollar may be ignored is unrealistic". Further, ARS #6 maintained that "general price-level financial statements should provide a basis for a more intelligent, better informed allocation of resources".[44] Rosenfeld states that general price-level financial statements:

> "are based on the same generally accepted accounting principles as conventional ("historical-dollar") financial statements except that changes in general purchasing power are recognized. All items in the restatements are given in a unit of measure which represents the same amount of general purchasing power. . . . Assets are restated at cost not at current value in general price level balance sheets. Cost is restated for changes in the general purchasing power of the dollar, but not for changes in specific prices of assets." [45]

Rosenfeld singles out three areas that are especially prone to historical-dollar distortion during inflationary periods:

Inventory holding gains as a result of using first-in-first-out inventory valuation. Underdepreciation of assets based upon historical-dollar costs. General price gains and losses, which result from holding monetary assets and liabilities, that are not reported in historical-dollar accounting financial statements.

44 "Reporting the Effect of Price Level Changes," Accounting Research Study #6, American Institute of Certified Public Accountants, New York, 1963, p. 16.

45 Rosenfeld, op.cit., p. 45.

SUMMARY

While these previous studies made a valuable contribution to the body of knowledge concerned with wealth redistribution during periods of inflation, they indicated areas that require further analysis.

This study, building upon the foundation of this previous work, will focus on net-monetary debt per dollar of earnings, the relative dividend payout ratio, under-depreciation of fixed assets when general price-level adjusted and historical-dollar accounting earnings are contrasted, and on the effects of FIFO inventory valuation.

CHAPTER III

ANALYTICAL FRAMEWORK

In this chapter a model will be formulated for true after-tax net nominal earnings, TANNE. This model will incorporate the inflationary effects upon historical-dollar earnings of: general price-level adjusted accounting depreciation, inventory holding gains and a net-monetary debtor position.

Further, a common stock valuation model will be formulated that incorporates: the firm's current dividend, the dividend yield of the market as a whole, the expected dividend growth rate of the firm relative to that of the market as a whole, and the risk premium of the firm relative to that of the market.

TRUE AFTER-TAX NET NOMINAL EARNINGS MODEL

Given the following balance sheet:

Cash (C)	Total Current Liabiliities (C/L)
Marketable Securities (MS)	Long Term Debt (LT)
Accounts Receivable (A/R)	Preferred Stock (PF)
Inventories (IN)	Book Value Equity (B)
Total Current Assets (C/A)	
Net Fixed Assets (FX)	
Total Assets (TA)	Total Liabilities & Equity (TLE)

$TLE = TA$

$C/L + LT + PF + B = C/A + FX$

Add and subtract IN from the right hand side.

$C/L + LT + PF + B = C/A - IN + FX + IN$

$B = (C/A - IN) - (C/L + LT + PF) + (FX + IN)$

The first term on the right hand side represents the firm's Monetary Assets (MA).

The second term on the right hand side represents the firm's Monetary Liabilities (ML).

The third term on the right hand side represents the firm's Real Assets (RA).

$B = MA - ML + FX + IN$

$B = FX + IN - (ML - MA)$

Let Net-Monetary Liabilities, $M = ML - MA$

$B = FX + IN - M$

at time; $t = o$

$B_o = FX_o + IN_o - M_o$

Model of a World Without Inflation

Under conditions of static equilibrium, in a world without risk, the real assets of the firm will grow at some normal real rate of return, r. The firm's net-monetary liabilities will grow at a real rate of interest, m, which is contractually specified. In a Wicksellian equilibrium $m = r$, because if $m < r$ the firm would continue to expand (contract) its stock of capital until the marginal revenue equals the marginal cost.

The normal gross real income for the firm, Y_1, in period 1, will be the difference between real asset growth and net monetary liability growth.

$$Y_1 = r(FX_o + IN_o) - m(M_o)$$

In a world with risk, the real assets of the firm will grow at some risk adjusted nominal rate of return, r_r.

$$r_r = r + w \qquad w = \text{a risk premium.}$$

The net-monetary liabilities of the firm will also grow at some risk adjusted nominal rate of return, m_r.

$$m_r = m + w$$

Thus gross nominal income, Y_1', will be:

$$Y_1' = r_r(FX_o + IN_o) - m_r(M_o)$$

In addition, there is a depreciation accounting effect which will decrease the gross nominal income.

The depreciation accounting effect would be some function of the gross fixed real assets, $a \cdot (GFX_1)$.

Where $a = g(L, DM)$

L = The average life of depreciable real assets. The longer the average life of the depreciable real assets, the lower will be the depreciation charge per period and the higher will be the nominal income per period.

DM = The accounting depreciation method adopted by the firm. The straight line method, in lieu of the accelerated methods, will result in a lower initial depreciation charge and thus higher nominal income for the period if the installation of real assets has been at a constant or increasing rate in the past.

The actual depreciation rate, DR, will reflect the combined effects of both L and DM.

Thus:

$$a = DR_1$$

DR_1 = The depreciation rate in period 1.

But:

$$DR_1 = \frac{DP_1}{GFX_1}$$

DP_1 = The depreciation charge in period 1.

So:

$$a = \frac{DP_1}{GFX_1}$$

And:

$$a \cdot (GFX_1) = \frac{DP_1}{GFX_1}(GFX_1) = DP_1$$

Thus the depreciation adjusted gross nominal income, Y_1'', will be:

$$Y_1'' = r_r(FX_o+IN_o) - DP_1 - m_r(M_o)$$

In a world with government, there will be taxes, G_1, which will reduce the depreciation adjusted gross nominal income, Y_1'''.

$$Y_1''' = r_r(FX_o+IN_o) - DP_1 - m_r(M_o) - G_1$$

Model of a World With Inflation

Assume that all prices increase at some rate K_1 the next period.

Where $K_1 = \dfrac{I_1 - I_o}{I_o}$ I = An appropriate price index.

Then, in equilibrium, the real assets of the firm must grow at a nominal rate $r' = r_r + K_1$.

Let F = The value of the real assets.

r_r = The risk adjusted nominal rate of return in a period of no inflation.

X = The normal real return on real assets.

$$r_r(F) = X$$

Assume that the normal income stream grows at $1 + K_1$ in order to maintain the real return on real assets, and that the real assets grow at $1 + K_1$ in order to maintain their real value. Then the nominal rate of growth of real assets, r', is:

$$r' = \frac{(1+K_1)X + (1+K_1)F - F}{F}$$

$$= \frac{(1+K_1)X}{F} + 1+K_1 - 1$$

Substitute: $r_r(F) = X$

$$r' = \frac{(1+K_1)r_r(F)}{F} + K_1$$

$$= (1+K_1)r_r + K_1$$

$$= r_r + K_1 r_r + K_1$$

but $K_1 r_r \simeq 0$ if both K and r_r take on small values.

So: $r' = r_r + K_1$

Thus the rate of return on FX_o+IN_o must grow at a nominal rate $r' = r_r + K_1$ while the book value of the net-monetary liabilities would not be affected by the price increase of K_1 per period. However, the embedded money rate of interest, $\bar{m}_p$, is the sum of the risk adjusted real rate of interest r_r plus the creditor's previous expectations about the then rate of anticipated inflation, $\bar{K}_p$.

$$\bar{m}_p = r_r + \bar{K}_p$$

Given inflation, the nominal earnings, $\hat{Y}_1$, would be:

$$\hat{Y}_1 = (r_r+K_1)(FX_o+IN_o) - DP_1 - \bar{m}_p(M_o) - G_1$$

It is further hypothesized that the depreciation accounting effect upon the nominal earnings will be modified by the rate of inflation, K_1.

The nominal earnings under conventional historical-dollar accounting are greater than they would be under general price-level adjusted accounting. This overstatement of nominal earnings results from the fact that the depreciation charge is understated as compared to the depreciation charge under general price-level adjusted accounting.

Rosenfeld[46] has indicated that to capture the full impact of this underdepreciation, assets should be restated under general price-level accounting to reflect the actual inflation since their acquisition.

Under general price-level accounting:

Let: GFX_1' = The general price-level adjusted gross fixed assets at the end of period 1.

CS_i = The capital spending, to acquire fixed assets, in the i^{th} period.

${}_j\tilde{R}_i$ = The general price-level adjusted fixed assets acquired in period j, that are retired in period i.

${}_j\gamma_i$ = The percentage of fixed assets acquired in period j that are retired in period i.

$$ {}_j\tilde{R}_i = I_i \sum_{j=-\infty}^{i} {}_j\gamma_i \left(\frac{CS_j}{I_j}\right) $$

46 Paul Rosenfeld, op.cit., p. 45.

At the end of period 1.

$$GFX_1' = I_1 \sum_{i=-\infty}^{1} \left(\frac{CS_i}{I_i} - \frac{{}_j\tilde{R}_i}{I_i}\right)$$

$$= I_1 \left(\sum_{i=-\infty}^{0} \left(\frac{CS_i}{I_i} - \frac{{}_j\tilde{R}_i}{I_i}\right) + \left(\frac{CS_1}{I_1} - \frac{\tilde{R}_1}{I_1}\right)\right)$$

$$GFX_o' = I_o \sum_{i=-\infty}^{0} \left(\frac{CS_i}{I_i} - \frac{{}_j\tilde{R}_i}{I_i}\right)$$

$$\Delta GFX' = GFX_1' - GFX_o'$$

$$= I_1 \sum_{i=-\infty}^{0} \left(\frac{CS_i}{I_i} - \frac{{}_j\tilde{R}_i}{I_i}\right) + CS_1 - \tilde{R}_1$$

$$- I_o \sum_{i=-\infty}^{0} \left(\frac{CS_i}{I_i} - \frac{{}_j\tilde{R}_i}{I_i}\right)$$

$$= (I_1 - I_o) \sum_{i=-\infty}^{0} \left(\frac{CS_i}{I_i} - \frac{{}_j\tilde{R}_i}{I_i}\right) + CS_1 - \tilde{R}_1$$

Under historical-dollar accounting:

Let: GFX_1 = The historical-dollar gross fixed assets at the end of period 1.

CS_i = The capital spending to acquire fixed assets in the i^{th} period.

${}_jR_i$ = The assets that were acquired in period j that are retired during period i.

${}_j\gamma_i$ = The percentage of fixed assets acquired in period j that are retired in period i.

$$GFX_1 = \sum_{i=-\infty}^{1} (CS_i - {}_jR_i)$$

Where

$$ {}_jR_i = \sum_{j=-\infty}^{1} {}_j\gamma_i \ (CS_j)$$

$$GFX_1 = \sum_{i=-\infty}^{0} (CS_i - {}_jR_i) + CS_1 - R_1$$

$$GFX_o = \sum_{i=-\infty}^{0} (CS_i - {}_jR_i)$$

$$\Delta GFX = GFX_1 - GFX_o$$

$$= CS_1 - R_1$$

Historical-dollar accounting, compared to general price-level accounting, understates the change in gross fixed assets in period 1 by:

$$\Delta GFX' - \Delta GFX = (I_1 - I_o) \sum_{i=-\infty}^{0} \left(\frac{CS_i}{I_i} - \frac{{}_j\tilde{R}_i}{I_i}\right) + CS_1 - \tilde{R}_1$$
$$- CS_1 + R_1$$

$$= (I_1 - I_o) \sum_{i=-\infty}^{0} \left(\frac{CS_i}{I_i} - \frac{{}_j\tilde{R}_i}{I_i}\right) + R_1 - \tilde{R}_1$$

$$\Delta GFX' - \Delta GFX = (I_1 - I_o) \sum_{i=-\infty}^{0} \left(\frac{CS_i}{I_i} - \sum_{j=-\infty}^{i} {}_j\gamma_i \left(\frac{CS_j}{I_j}\right)\right)$$
$$+ \sum_{j=-\infty}^{1} {}_j\gamma_1 (CS_j) - I_1 \sum_{j=-\infty}^{1} {}_j\gamma_1 \left(\frac{CS_j}{I_j}\right)$$

Multiplying the 2^{nd} term R.H.S. by $\frac{I_j}{I_j}$

$$\Delta GFX' - \Delta GFX = (I_1 - I_o) \sum_{i=-\infty}^{o} \left(\frac{CS_i}{I_i} - \sum_{j=-\infty}^{i} {}_j\gamma_i \left(\frac{CS_j}{I_j}\right)\right)$$

$$+ \sum_{j=-\infty}^{1} I_j \; {}_j\gamma_1 \left(\frac{CS_j}{I_j}\right) - I_1 \sum_{j=-\infty}^{1} {}_j\gamma_1 \left(\frac{CS_j}{I_j}\right)$$

$$= (I_1 - I_o) \sum_{i=-\infty}^{o} \frac{CS_i}{I_i}$$

$$- (I_1 - I_o) \sum_{i=-\infty}^{o} \sum_{j=-\infty}^{i} {}_j\gamma_i \left(\frac{CS_j}{I_j}\right)$$

$$+ \sum_{j=-\infty}^{1} I_j \; {}_j\gamma_1 \left(\frac{CS_j}{I_j}\right) - I_1 \sum_{j=-\infty}^{1} {}_j\gamma_1 \left(\frac{CS_j}{I_j}\right)$$

To develop the coefficients of the $\frac{CS_i}{I_i}$ and the $\frac{CS_j}{I_j}$ terms.

Let:	1^{st} Term Right Hand Side
$i = j = 1$	0
$i = o \quad j = o$	$(I_1 - I_o)\frac{CS_o}{I_o}$
$i = -1 \quad j = o, -1$	$(I_1 - I_o)\frac{CS_{-1}}{I_{-1}}$
$i = -2 \quad j = o, -1, -2$	$(I_1 - I_o)\frac{CS_{-2}}{I_{-2}}$
$i = -3 \quad j = o, -1, -2, -3$	$(I_1 - I_o)\frac{CS_{-3}}{I_{-3}}$
$\vdots$	
N	

	2^{nd} Term Right Hand Side
$i = j = 1$	0
$i = o \quad j = o$	$-(I_1 - I_o)\ {}_o\gamma_o \frac{CS_o}{I_o}$
$i = -1 \quad j = o, -1$	$-(I_1 - I_o)(\frac{CS_{-1}}{I_{-1}})({}_{-1}\gamma_o + {}_{-1}\gamma_{-1})$
$i = -2 \quad j = o, -1, -2$	$-(I_1 - I_o)(\frac{CS_{-2}}{I_{-2}})({}_{-2}\gamma_o + {}_{-2}\gamma_{-1} + {}_{-2}\gamma_{-2})$
$i = -3 \quad j = o, -1, -2, -3$	$-(I_1 - I_o)(\frac{CS_{-3}}{I_{-3}})({}_{-3}\gamma_o + {}_{-3}\gamma_{-1} + {}_{-3}\gamma_{-2} + {}_{-3}\gamma_{-3})$
$\vdots$	
N	

Let:

$i = j = 1$

$i = o \quad j = o$

$i = -1 \quad j = o, -1$

$i = -2 \quad j = o, -1, -2$

$i = -3 \quad j = o, -1, -2, -3$

$\vdots$

N

<u>3rd Term Right Hand Side</u>

$I_1 \; {}_1\gamma_1 \dfrac{CS_1}{I_1}$

$I_o \; {}_o\gamma_1 \dfrac{CS_o}{I_o}$

$I_{-1} \; {}_{-1}\gamma_1 \dfrac{CS_{-1}}{I_{-1}}$

$I_{-2} \; {}_{-2}\gamma_1 \dfrac{CS_{-2}}{I_{-2}}$

$I_{-3} \; {}_{-3}\gamma_1 \dfrac{CS_{-3}}{I_{-3}}$

<u>4th Term Right Hand Side</u>

$i = j = 1$ $\qquad - I_1 \; {}_1\gamma_1 \dfrac{CS_1}{I_1}$

$i = o \quad j = o$ $\qquad - I_1 \; {}_o\gamma_1 \dfrac{CS_o}{I_o}$

$i = -1 \quad j = o, -1$ $\qquad - I_1 \; {}_{-1}\gamma_1 \dfrac{CS_{-1}}{I_{-1}}$

$i = -2 \quad j = o, -1, -2$ $\qquad - I_1 \; {}_{-2}\gamma_1 \dfrac{CS_{-2}}{I_{-2}}$

$i = -3 \quad j = o, -1, -2, -3$ $\qquad - I_1 \; {}_{-3}\gamma_1 \dfrac{CS_{-3}}{I_{-3}}$

$\vdots$

N

Then when:

$i=1, \quad \Delta GFX' - \Delta GFX = o$

$i=o, \quad \Delta GFX' - \Delta GFX = (I_1 - I_o)(\frac{CS_o}{I_o})(1 - {}_o\gamma_o) - (I_1 - I_o)_o\gamma_1 \frac{CS_o}{I_o}$

$i=-1, \Delta GFX' - \Delta GFX = (I_1 - I_o)\frac{CS_{-1}}{I_{-1}}(1 - {}_{-1}\gamma_o - {}_{-1}\gamma_{-1})$

$$- (I_1 - I_{-1})_{-1}\gamma_1 \frac{CS_{-1}}{I_{-1}}$$

$i=-2, \Delta GFX' - \Delta GFX = (I_1 - I_o)\frac{CS_{-2}}{I_{-2}}(1 - {}_{-2}\gamma_o - {}_{-2}\gamma_{-1} - {}_{-2}\gamma_{-2})$

$$- (I_1 - I_{-2})_{-2}\gamma_1 \frac{CS_{-2}}{I_{-2}}$$

$i=-3, \Delta GFX' - \Delta GFX = (I_1 - I_o)\frac{CS_{-3}}{I_{-3}}(1 - {}_{-3}\gamma_o - {}_{-3}\gamma_{-1} - {}_{-3}\gamma_{-2}$

$$- {}_{-3}\gamma_{-3}) - (I_1 - I_{-3})\ {}_{-3}\gamma_1 \frac{CS_{-3}}{I_{-3}}$$

Let:

$${}_o\gamma_o = {}_{-1}\gamma_{-1} = {}_{-2}\gamma_{-2} = {}_{-3}\gamma_{-3} = \cdots = {}_{-n}\gamma_{-n} = B_o$$

$${}_o\gamma_1 = {}_{-1}\gamma_o = {}_{-2}\gamma_{-1} = {}_{-3}\gamma_{-2} = {}_{-4}\gamma_{-3} = \cdots = {}_{-n-1}\gamma_{-n} = B_1$$

$${}_{-1}\gamma_1 = {}_{-2}\gamma_o = {}_{-3}\gamma_{-1} = {}_{-4}\gamma_{-2} = {}_{-5}\gamma_{-3} = \cdots = {}_{-n-2}\gamma_{-n} = B_2$$

Where B_h is the percentage of the period's capital spending that is replaced h periods later.

Then when:

$i=1, \quad \Delta GFX' - \Delta GFX = o$

$i=o, \quad \Delta GFX' - \Delta GFX = (I_1 - I_o)(1 - B_o)\frac{CS_o}{I_o} - (I_1 - I_o)B_1\frac{CS_o}{I_o}$

$i=-1, \Delta GFX' - \Delta GFX = (I_1 - I_o)(1 - B_1 - B_o)\frac{CS_{-1}}{I_{-1}}$

$$- (I_1 - I_{-1})B_2 \frac{CS_{-1}}{I_{-1}}$$

$$i = -2,\ \Delta GFX' - \Delta GFX = (I_1 - I_o)(1 - B_2 - B_1 - B_o)\frac{CS_{-2}}{I_{-2}}$$

$$- (I_1 - I_{-2})B_3\frac{CS_{-2}}{I_{-2}}$$

$$i = -3,\ \Delta GFX' - \Delta GFX = (I_1 - I_o)(1 - B_3 - B_2 - B_1 - B_o)$$

$$\frac{CS_{-3}}{I_{-3}} - (I_1 - I_{-3})B_4\frac{CS_{-3}}{I_{-3}}$$

In the generalized form this reduces to:

$$\Delta GFX' - \Delta GFX = \sum_{i=o}^{-\infty}\left\{\left[\frac{CS_i}{I_i}\right]\left[(I_1-I_o)(1-\sum_{h=o}^{i}B_h)-B_{1-i}(I_1-I_i)\right]\right\}$$

Substituting K_1

$$\Delta GFX' - \Delta GFX = \sum_{i=o}^{-\infty}\left\{\left[\frac{CS_i}{I_i}\right]\left[(K_1 I_o)(1-\sum_{h=o}^{i}B_h)-B_{1-i}(I_o(1+K_1)-I_i)\right]\right\}$$

The change in gross fixed assets is understated in period 1 by $\Delta GFX' - \Delta GFX$, and thus the depreciation in period 1 will be undercharged by:

$$\Delta DP_1 = DR_1(\Delta GFX' - \Delta GFX)$$

Then:

let $K_1(DP_1') = DR_1(\Delta GFX' - \Delta GFX)$

Thus the nominal earnings, $\hat{Y}_1$, are overstated by $K_1(DP_1')$. Net nominal earnings, $\hat{Y}_1'$, would be:

$$\hat{Y}_1' = (r_r+K_1)(FX_o+IN_o) - DP_1 - K_1(DP_1') - \bar{m}_p(M_o) - G_1$$

In a period of inflation there may be an increase in the net nominal earnings due to an historical-dollar inventory accounting effect. This inventory accounting effect would be due to the differential impact of inflation upon the cost of goods sold. If the last-in first-out (LIFO) method of inventory valuation is adopted the major portion of the inflationary impact will be reflected in the cost of goods sold. However, if the first-in-first-out (FIFO) valuation method is adopted a much smaller portion of the inflationary impact will be embodied in the cost of goods sold. It is this differential effect of historical-dollar valuation upon net nominal earnings in a period of inflation that we would like to examine.

It is hypothesized that this differential accounting effect is some function of the real inventory, $c(FX_o)$. Where:

$$c = V_1(j(T_1, K_1))$$

V_1 = The inventory valuation method. If the firm is on LIFO there will be no differential accounting effect upon net nominal earnings. If the firm is on FIFO there will be an increase in net nominal earnings.

Thus V_1 is a dummy variable such that:

$V_1 = 0$ if LIFO

$V_1 = 1$ if FIFO

T_1 = The inventory turnover rate, the cost of goods sold divided by the initial inventory, will effect the differential net nominal earnings. As the inventory turnover increases the change in net nominal earnings per inventory turnover will decrease. However, as the inventory turnover increases the change in differential net nominal earnings will increase at a decreasing rate.

K_1 = The rate of inflation, the greater the rate, the greater will be the increase in differential net nominal earnings.

The differential net nominal earnings effect due to the inventory valuation method would be developed as follows:

Let: Y_F = Nominal income with FIFO inventory valuation.

Y_L = Nominal income with LIFO inventory valuation.

S = Sales for the period.

C_F = The cost of goods sold using FIFO valuation.

C_L = The cost of goods sold using LIFO valuation.

$$Y_F = S - C_F$$

$$Y_L = S - C_L$$

$$Y_F - Y_L = \Delta Y = S - C_F - S + C_L$$

$$\Delta Y = C_L - C_F$$

To approximate the functional relationship between K_1 and T_1, we assume the following:

a. That production and sales are developed at an even rate within the period.

b. That the rate of inflation, K_1, is constant within the period.

Assume an inventory turnover rate, $T_1 = 1$

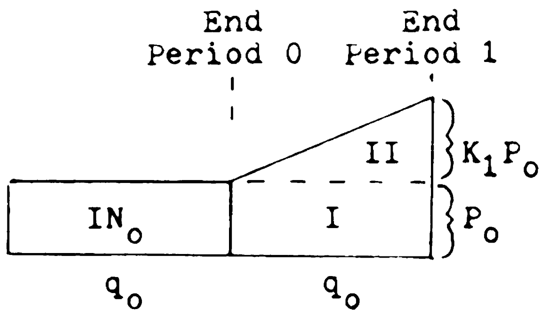

Fig. 1

$$COGS_F = IN_o$$

$$COGS_L = I + II \text{ (see Fig. 1)}$$

$$COGS_L = P_oq_o + P_oq_o\left(\frac{K_1}{2}\right)$$

$$= P_oq_o\left(1 + \frac{K_1}{2}\right)$$

$$= IN_o\left(1 + \frac{K_1}{2}\right)$$

$$\Delta Y = COGS_L - COGS_F$$

$$= IN_o\left(1 + \frac{K_1}{2}\right) - IN_o$$

$$= IN_o\left(1 + \frac{K_1}{2} - 1\right)$$

$$= IN_o\,\frac{K_1}{2}$$

Now assume an inventory turnover rate, $T_1 = 2$

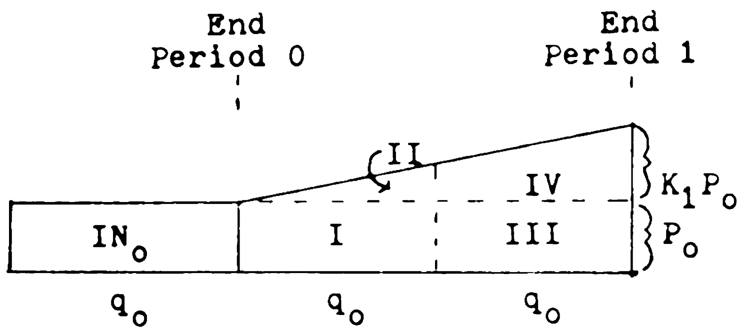

Fig. 2

$$COGS_F = IN_o + I + II \text{ (see Fig. 2)}$$

$$= IN_o + P_o q_o + P_o q_o (\tfrac{1}{2}) \frac{K_1}{2}$$

$$= 2IN_o + IN_o (\frac{K_1}{4})$$

$$= IN_o (2 + \frac{K_1}{4})$$

$$COGS_L = I + II + III + IV \text{ (see Fig. 2)}$$

$$= I + III + (II + IV)$$

$$= P_o q_o + P_o q_o + P_o (2q_o)(\tfrac{1}{2})K_1$$

$$= 2P_o q_o + P_o q_o \ (K_1)$$

$$= IN_o (2+K_1)$$

$$\Delta Y = IN_o (2+K_1) - IN_o (2 + \frac{K_1}{4})$$

$$= IN_o (\tfrac{3}{4} K_1)$$

Thus:

$$\Delta Y = K_1(1 - \frac{1}{2T_1})\ IN_o$$

$$c = V_1(K_1(1 - \frac{1}{2T_1}))$$

$$c(IN_o) = V_1(K_1(1 - \frac{1}{2T_1}))(IN_o)$$

Where $V_1 = 0$ if LIFO

$V_1 = 1$ if FIFO

Thus earnings for the period would be increased by this differential historical-dollar inventory accounting effect during an inflationary period. However, to obtain adjusted net nominal earnings, $\hat{Y}_1''$, this differential historical-dollar inventory accounting effect must be subtracted. To accommodate the effect of taxation, later in this study, the differential historical-dollar inventory accounting effect will be both added and subtracted from the adjusted net nominal earnings.

Thus:

$$\hat{Y}_1'' = (r_r+K_1)(FX_o+IN_o)-DP_1-K_1(DP_1')+V_1(K_1)(1 - \frac{1}{2T_1})IN_o$$
$$- V_1(K_1)(1 - \frac{1}{2T_1})IN_o-\bar{m}_p(M_o) - G_1$$

Substituting $\bar{m}_p = r_r + \bar{K}_p$ in the 6^{th} term R.H.S.

$$\hat{Y}_1'' = (r_r+K_1)(FX_o+IN_o)-DP_1-K_1(DP_1')+V_1(K_1)(1 - \frac{1}{2T_1})IN_o$$
$$- V_1(K_1)(1 - \frac{1}{2T_1})IN_o-(r_r+\bar{K}_p)M_o - G_1$$

$$\hat{Y}_1'' = r_r(FX_o+IN_o)+K_1(FX_o+IN_o)-DP_1-K_1(DP_1')$$

$$+V_1(K_1)(1-\frac{1}{2T_1})IN_o-V_1(K_1)(1-\frac{1}{2T_1})IN_o-r_r(M_o)$$

$$-\bar{K}_p(M_o) - G_1$$

Combining terms:

$$\hat{Y}_1'' = r_r(FX_o+IN_o-M_o)+K_1(FX_o+IN_o)-DP_1-K_1(DP_1')$$

$$+V_1(K_1)(1-\frac{1}{2T_1})IN_o-V_1(K_1)(1-\frac{1}{2T_1})IN_o-\bar{K}_p(M_o) - G_1$$

But $FX_o+IN_o-M_o = B_o$ substituting in the 1^{st} term R.H.S.

$$\hat{Y}_1'' = r_r(B_o)+K_1(FX_o+IN_o)-DP_1-K_1(DP_1')+V_1(K_1)(1-\frac{1}{2T_1})IN_o$$

$$-V_1(K_1)(1-\frac{1}{2T_1})IN_o-\bar{K}_p(M_o) - G_1$$

But $FX_o+IN_o = B_o+M_o$ substituting in the 2^{nd} term R.H.S.

$$\hat{Y}_1'' = r_r(B_o)+K_1(B_o+M_o)-DP_1-K_1(DP_1')+V_1(K_1)(1-\frac{1}{2T_1})IN_o$$

$$-V_1(K_1)(1-\frac{1}{2T_1})IN_o-\bar{K}_p(M_o) - G_1$$

$$\hat{Y}_1'' = r_r(B_o)+K_1(B_o)+K_1(M_o)-DP_1-K_1(DP_1')+V_1(K_1)(1-\frac{1}{2T_1})IN_o$$

$$-V_1(K_1)(1-\frac{1}{2T_1})IN_o-\bar{K}_p(M_o) - G_1$$

Combining terms:

$$\hat{Y}_1'' = (r_r+K_1)B_o-DP_1-K_1(DP_1')+V_1(K_1)(1-\frac{1}{2T_1})IN_o$$

$$-V_1(K_1)(1-\frac{1}{2T_1})IN_o+K_1(M_o)-\bar{K}_p(M_o) - G_1$$

But $\bar{K}_p = \bar{m}_p - r_r$ substituting in the 7^{th} term R.H.S.

$$\hat{Y}_1'' = (r_r+K_1)B_o-DP_1-K_1(DP_1^{\bullet\prime})+V_1(K_1)(1 - \frac{1}{2T_1})IN_o$$

$$- V_1(K_1)(1 - \frac{1}{2T_1})IN_o+K_1(M_o)-(\bar{m}_p-r_r)M_o - G_1$$

Combining terms:

$$\hat{Y}_1'' = (r_r+K_1)B_o-DP_1-K_1(DP_1^{\bullet\prime})+V_1(K_1)(1 - \frac{1}{2T_1})IN_o$$

$$- V_1(K_1)(1 - \frac{1}{2T_1})IN_o+(r_r+K_1)M_o-\bar{m}_p(M_o) - G_1$$

The taxes, G_1, are a function of historical-dollar accounting nominal earnings, and not a function of adjusted net nominal earnings.

Thus:

$$G_1 = t_1\left[(r_r+K_1)B_o-DP_1+V_1(K_1)(1 - \frac{1}{2T_1})IN_o-\bar{m}_p^*(LT_o)\right]$$

Where:

$\bar{m}_p^*$ = The embedded cost of debt.

LT_o = The amount of debt outstanding in period 0.

Thus:

$$\bar{m}_p^* = \frac{C_o}{LT_o}$$

C_o = Fixed charges in period 0.

PD_o = Preferred Dividend in period 0.

And:

$$\bar{m}_p = \frac{C_o + PD_o}{LT_o + PF_o}$$

PF_o = Preferred stock at redemption value in period 0.

Divide numerator and denominator of each term R.H.S. by LT_o.

$$\bar{m}_p = \frac{\frac{C_o}{LT_o} + \frac{PD_o}{LT_o}}{\frac{LT_o}{LT_o} + \frac{PF_o}{LT_o}} = \frac{\frac{C_o}{LT_o} + \frac{PD_o}{LT_o}}{1 + \frac{PF_o}{LT_o}}$$

But:

$$\bar{m}_p^* = \frac{C_o}{LT_o}$$

So:

$$\bar{m}_p = \frac{\bar{m}_p^* + \frac{PD_o}{LT_o}}{1 + \frac{PF_o}{LT_o}}$$

Or:

$$\bar{m}_p(1 + \frac{PF_o}{LT_o}) = \bar{m}_p^* + \frac{PD_o}{LT_o}$$

$$\bar{m}_p^* = \bar{m}_p(1 + \frac{PF_o}{LT_o}) - \frac{PD_o}{LT_o}$$

Multiply through by LT_o:

$$\bar{m}_p^*(LT_o) = \bar{m}_p(1 + \frac{PF_o}{LT_o})(LT_o) - \frac{PD_o}{LT_o}(LT_o)$$

$$= \bar{m}_p(LT_o) + \bar{m}_p(PF_o) - PD_o$$

Now:

$$M_o = ML_o - MA_o$$

$$= LT_o + CL_o + PF_o - (CA_o - IN_o)$$

ML_o = Monetary liabilities.

MA_o = Monetary assets.

CL_o = Current liabilities.

CA_o = Current assets.

So:

$$LT_o = M_o - CL_o - PF_o + (CA_o - IN_o)$$

And:

$$\bar{m}_p^*(LT_o) = \bar{m}_p\left[M_o - (CL_o + PF_o - CA_o + IN_o)\right] + \bar{m}_p(PF_o) - PD_o$$

$$= \bar{m}_p(M_o) - \bar{m}_p(CL_o + PF_o - CA_o + IN_o - PF_o) - PD_o$$

$$= \bar{m}_p(M_o) - \bar{m}_p(CL_o - CA_o + IN_o) - PD_o$$

Then:

$$G_1 = t_1\left[(r_r + K_1)B_o - DP_1 + V_1(K_1)(1 - \frac{1}{2T_1})IN_o - \bar{m}_p^*(LT_o)\right]$$

$$= t_1\left[(r_r + K_1)B_o - DP_1 + V_1(K_1)(1 - \frac{1}{2T_1})IN_o - \bar{m}_p(M_o)\right.$$

$$\left. + \bar{m}_p(CL_o - CA_o + IN_o) + PD_o\right]$$

Substituting for G_1:

$$\hat{Y}_1'' = (r_r+K_1)B_o-DP_1-K_1(DP_1')+V_1(K_1)(1-\frac{1}{2T_1})IN_o$$

$$-V_1(K_1)(1-\frac{1}{2T_1})IN_o+(r_r+K_1)M_o-\bar{m}_p(M_o)-t_1\Big[(r_r+K_1)B_o$$

$$-DP_1+V_1(K_1)(1-\frac{1}{2T_1})IN_o-\bar{m}_p(M_o)+\bar{m}_p(CL_o-CA_o+IN_o)+PD_o)\Big]$$

$$= (1-t_1)(r_r+K_1)B_o-(1-t_1)(DP_1)$$

$$+(1-t_1)(V_1)(K_1)(1-\frac{1}{2T_1})IN_o-(1-t_1)(\bar{m}_p)M_o$$

$$-t_1(\bar{m}_p)(CL_o-CA_o+IN_o)-t_1(PD_o)-K_1(DP_1')$$

$$-V_1(K_1)(1-\frac{1}{2T_1})IN_o+(r_r+K_1)M_o$$

In order to develop true after-tax net nominal earnings available to common stock holders E_1', preferred dividends in period 1, PD_1, must be subtracted from adjusted net nominal earnings, $\hat{Y}_1''$.

$$E_1' = \Big[(1-t_1)(r_r+K_1)B_o-(1-t_1)DP_1+(1-t_1)(V_1)(K_1)(1-\frac{1}{2T_1})IN_o$$

$$-(1-t_1)(\bar{m}_p)\ M_o-t_1(\bar{m}_p)(CL_o-CA_o+IN_o)-t_1PD_o-PD_1\Big]$$

$$-K_1(DP_1')-V_1(K_1)(1-\frac{1}{2T_1})IN_o+(r_r+K_1)M_o$$

The [ ] term on the R.H.S. is historical-dollar accounting earnings available to common stockholders, E_1.

So that:

$$E_1' = E_1 - K_1(DP_1') - V_1(K_1)(1 - \frac{1}{2T_1})IN_o + (r_r + K_1)M_o$$

Substituting back for the 2^{nd} term R.H.S.:

$$K_1(DP_1') = DR_1 \sum_{i=o}^{-\infty} \left\{ \left[\frac{CS_i}{I_i} \right] \left[(K_1 I_o)(1 - \sum_{h=o}^{i} B_h) - B_{1-i}(I_o(1+K_1) - I_i) \right] \right\}$$

Then:

$$E_1' = E_1 - DR_1 \sum_{i=o}^{-\infty} \left\{ \left[\frac{CS_i}{I_i} \right] \left[(K_1 I_o)(1 - \sum_{h=o}^{i} B_h) - B_{1-i}(I_o(1+K_1) - I_i) \right] \right\}$$
$$- V_1(K_1)(1 - \frac{1}{2T_1})IN_o + (r_r + K_1)M_o$$

Thus we have formulated a model of true after-tax net nominal earnings, or TANNE.

The economic significance of each of the terms is:

E_1: Represents the increase in TANNE due to historical-dollar accounting earnings.

$$-DR_1 \sum_{i=o}^{-\infty} \left\{ \left[\frac{CS_i}{I_i} \right] \left[(K_1 I_o)(1 - \sum_{h=o}^{i} B_h) - B_{1-i}(I_o(1+K_1) - I_i) \right] \right\} :$$

Represents the decrease in TANNE due to the under depreciation of gross fixed assets in an inflationary period caused by the difference between historical-dollar and general price-level adjusted depreciation.

$-V_1(K_1)(1 - \frac{1}{2T_1})IN_0$: Represents the decrease in TANNE due to inflation caused inventory holding gains.

$(r_r+K_1)M_0$: Represents the increase in TANNE due to a net-monetary debtor position in an inflationary period.

Common Stock Valuation Model Based Upon Historical-Dollar Accounting Earnings

Let us assume that:

1. The firm will generate a constant dividend stream forever.
2. The annual dividend is expected to grow at a constant rate of, g, per period.
3. The cost of equity capital to the firm is defined as the market rate of discount, k_{eo} in period 0.
4. $k_{eo} > g$.
5. D_o is the common stock dividend in period 0.

Then for the continuous case:[47]

[47] John Burr Williams, Theory of Investment Value, Harvard University Press, (1938). Also: David Durand, "Growth Stocks and Petersburg Paradox," Journal of Finance, vol. XII, (Sept., 1957), pp. 348-363.

$$P_o = \int_{t=o}^{\infty} D_o e^{gt} e^{-k_{eo}t} dt$$

$$= \int_{t=o}^{\infty} D_o e^{-t(k_{eo}-g)} dt$$

Integrating the R.H.S.

$$P_o = \frac{D_o}{k_{eo}-g_o}$$

Let $b_o = \frac{D_o}{E_o}$ Where b_o = The dividend payout ratio in period 0.

And:

$$k_{eo} = \frac{b_o E_o}{P_o} + g_o$$

But:

$k_{eo} \equiv k_o + w_o$

k_o = The riskless market rate of discount in period 0.

w_o = The risk premium on the firm's equity capital in period 0.

Or:

$$k_o = k_{eo} - w_o$$

$$k_o = \frac{b_o E_o}{P_o} + g_o - w_o$$

Let the superscript m denote the stock market.

Then:

$$k^m_{eo} = \frac{b^m_o E^m_o}{P^m_o} + g^m_o$$

And:

$$k^m_o = k^m_{eo} - w^m_o$$

So:

$$k^m_o = b^m_o \frac{E^m_o}{P^m_o} + g^m_o - w^m_o$$

But:

$$k_o = k^m_o$$

So:

$$b_o \frac{E_o}{P_o} + g_o - w_o = b^m_o \frac{E^m_o}{P^m_o} + g^m_o - w^m_o$$

$$b_o \frac{E_o}{P_o} = b^m_o \frac{E^m_o}{P^m_o} + (g^m_o - g_o) - (w^m_o - w_o)$$

$$\frac{E_o}{P_o} = \frac{b^m_o E^m_o}{b_o P^m_o} + \frac{(g^m_o - g_o) - (w^m_o - w_o)}{b_o}$$

$$= \frac{b^m_o E^m_o + P^m_o ((g^m_o - g_o) - (w^m_o - w_o))}{b_o P^m_o}$$

Inverting both sides:

$$\frac{P_o}{E_o} = \frac{b_o\ P_o^m}{b_o^m\ E_o^m + P_o^m((g_o^m - g_o) - (w_o^m - w_o))}$$

Multiplying both sides by E_o:

$$P_o = \frac{E_o b_o P_o^m}{b_o^m\ E_o^m + P_o^m((g_o^m - g_o) - (w_o^m - w_o))}$$

This can be simplified by substituting $D_o = b_o E_o$ and $D_o^m = b_o^m\ E_o^m$, and dividing the numerator and the denominator of the R.H.S. by P_o^m.

So that:

$$P_o = \frac{D_o}{\frac{D_o^m}{P_o^m} + (g_o^m - g_o) - (w_o^m - w_o)}$$

Thus we have developed a common stock valuation model based upon the historical-dollar dividend per share, the dividend yield for the market as a whole, the expected dividend growth rate for the firm relative to that of the market, and the risk premium for the firm relative to that of the market as a whole.

The economic significance of each of the terms is as follows:

D_o : If the dividend per share increases, then the market price per share increases.

$\frac{D_o^m}{P_o^m}$: If the dividend yield for the market as a whole decreases, then the price per share increases. This reflects the fact that when the dividend yield for the market falls it is because investors are willing to pay a higher price for a dollar of dividends, and some portion of this multiple should apply to the firm's price per share.

$g_o^m - g_o$: If the expected dividend growth rate for the firm increases relative to that of the market as a whole, the price per share increases.

$-(w_o^m - w_o)$: If the risk premium for the firm increases relative to that of the market, the price per share decreases.

SUMMARY

Models have been formulated for true after-tax net nominal earnings, TANNE, and for common stock valuation based upon historical-dollar accounting. In the next chapter a regression model will be developed incorporating true after-tax net nominal earnings within the framework of the common stock valuation model.

CHAPTER IV

REGRESSION MODEL BASED UPON TRUE AFTER-TAX NET NOMINAL EARNINGS

In this chapter the common stock valuation model will be extended to incorporate true after-tax net nominal earnings. Using this extended model, a price relative model will be constructed. Finally, the price relative model will be converted to a regression model for testing in Chapter V.

Regression analysis was chosen for the following reasons:

1. We will be examining a single pre-screened population of manufacturing firms.
2. The price relative theoretical model has clearly indicated those variables which should be important in the determination of relative share prices.
3. Discriminant analysis was considered, but it is not applicable to a single population because its power lies in examining characteristics (variables) of the individual elements in the sample to

determine if the element was drawn from one or another of the underlying populations.

4. Cluster analysis was rejected because in this study we are not attempting to determine the variables that determine relative share prices, rather we have developed these and wish to test them.

REGRESSION MODEL DEVELOPMENT

Let us assume that:

1. The firm will generate a constant dividend stream forever.
2. The annual dividend is expected to grow at a constant rate of g', per period.
3. The cost of equity capital to the firm is defined as the market rate of discount, k_{eo}.
4. $k_{eo} > g'$.
5. The common stock dividend in period 0, D_o', is based upon the true after-tax net nominal earnings.

Then for the continuous case:

$$P_o' = \int_{t=o}^{\infty} D_o' e^{g't} e^{-k_{eo}t} dt$$

P_o' = The price per share of common stock based upon TANNE.

$$= \int_{t=o}^{\infty} D_o' e^{-t(k_{eo}-g')} dt$$

Integrating the R.H.S.

$$P_o' = \frac{D_o'}{k_{eo}-g_o}$$

Based upon the premise that the market is efficient the market price per share, P_o, will have discounted historical-dollar earnings so that:

$$P_o' = P_o$$

Thus:

$$P_o = \frac{D_o'}{k_{eo}-g_o}$$

Let:

$$b_o' = \frac{D_o'}{E_o'}$$

Where b_o' = The dividend payout ratio based upon TANNE.

Then:

$$D_o' = b_o' E_o'$$

And:

$$P_o = \frac{b_o' E_o'}{k_{eo}-g_o}$$

Multiplying both sides by $k_{eo}-g_o'$ and dividing both sides by P_o:

$$k_{eo}-g_o' = \frac{b_o'E_o'}{P_o}$$

Add g_o' to both sides:

$$k_{eo} = \frac{b_o'E_o'}{P_o} + g_o'$$

But:

$$k_{eo} \equiv k_o + w_o'$$

k_o = The riskless rate of discount in period 0.

w_o' = The risk premium on the firm's equity capital in period 0, based upon TANNE.

Or:

$$k_o = k_{eo} - w_o'$$

Substituting for k_{eo}:

$$k_o = \frac{b_o'E_o'}{P_o} + g_o' - w_o'$$

Let the superscript m denote the stockmarket as a whole:

$$k_o^m = b_o'^m \frac{E_o'^m}{P_o^m} + g_o'^m - w_o'^m$$

But the riskless rate of discount for the firm must be equal to the riskless rate of discount for the market as a whole in period 0. So:

$$k_o = k_o^m$$

Then:

$$\frac{b'_o E'_o}{P_o} + g'_o - w'_o = b_o^{'m} \frac{E_o^{'m}}{P_o^m} + g_o^{'m} - w_o^{'m}$$

Subtract $g'_o - w'_o$ from both sides:

$$\frac{b'_o E'_o}{P_o} = b_o^{'m} \frac{E_o^{'m}}{P_o^m} + (g_o^{'m} - g'_o) - (w_o^{'m} - w'_o)$$

Divide both sides by b'_o:

$$\frac{E'_o}{P_o} = \frac{b_o^{'m} E_o^{'m}}{b'_o \quad P_o^m} + \frac{(g_o^{'m} - g'_o) - (w_o^{'m} - w'_o)}{b'_o}$$

Multiply 2^{nd} term R.H.S. by $\frac{P_o^m}{P_o^m}$:

$$\frac{E'_o}{P_o} = \frac{b_o^{'m} E_o^{'m} + P_o^m((g_o^{'m} - g'_o) - (w_o^{'m} - w'_o))}{b'_o \quad P_o^m}$$

Inverting both sides:

$$\frac{P_o}{E'_o} = \frac{b'_o \quad P_o^m}{b_o^{'m} E_o^{'m} + P_o^m((g_o^{'m} - g'_o) - (w_o^{'m} - w'_o))}$$

Multiplying both sides E'_o:

$$P_o = \frac{b'_o \; E'_o \; P_o^m}{b_o^{'m} E_o^{'m} + P_o^m((g_o^{'m} - g'_o) - (w_o^{'m} - w'_o))}$$

Dividing numerator and denominator R.H.S. by P_o^m:

$$P_o = \frac{b_o' E_o'}{\frac{b_o'^m E_o'^m}{P_o^m} + (g_o'^m - g_o') - (w_o'^m - w_o')}$$

Likewise:

$$P_1 = \frac{b_1' E_1'}{\frac{b_1'^m E_1'^m}{P_1^m} + (g_1'^m - g_1') - (w_1'^m - w_1')}$$

Dividing both sides of the above equation by P_o:

$$\frac{P_1}{P_o} = b_1' E_1' \frac{1}{\frac{b_1'^m E_1'^m}{P_1^m} + (g_1'^m - g_1') - (w_1'^m - w_1')} \frac{1}{P_o}$$

Multiply R.H.S. by $\dfrac{b_o E_o}{b_o E_o}$

Where:

b_o = Historical-dollar accounting earnings dividend payout ratio.

E_o = Historical-dollar accounting earnings.

$$\frac{P_1}{P_o} = \frac{b_1' E_1'}{b_o E_o} \frac{1}{\frac{b_1'^m E_1'^m}{P_1^m} + (g_1'^m - g_1') - (w_1'^m - w_1')} \frac{b_o E_o}{P_o}$$

But:

$$\frac{b_o\ E_o}{P_o} = \frac{b_o^m\ E_o^m}{P_o^m} + (g_o^m - g_o) - (w_o^m - w_o)$$

On the R.H.S. $\quad b_o^m\ E_o^m = D_o^m$

So that:

$$\frac{b_o E_o}{P_o} = \frac{D_o^m}{P_o^m} + (g_o^m - g_o) - (w_o^m - w_o)$$

Substituting for $\dfrac{b_o\ E_o}{P_o}$ in the last term R.H.S.:

$$\frac{P_1}{P_o} = \left[\frac{b_1'\ E_1'}{b_o\ E_o}\right]\left[\frac{\dfrac{D_o^m}{P_o^m} + (g_o^m - g_o) - (w_o^m - w_o)}{\dfrac{b_1'^m\ E_1'^m}{P_1^m} + (g_1'^m - g_1') - (w_1'^m - w_1')}\right]$$

Also:

$$D_1'^m = b_1'^m\ E_1'^m$$

Substituting in the denominator of the 2nd term R.H.S.:

$$\frac{P_1}{P_o} = \left[\frac{b_1'\ E_1'}{b_o\ E_o}\right]\left[\frac{\dfrac{D_o^m}{P_o^m} + (g_o^m - g_o) - (w_o^m - w_o)}{\dfrac{D_1'^m}{P_1^m} + (g_1'^m - g_1') - (w_1'^m - w_1')}\right]$$

Now let:

$$X_o = \frac{D_o^m}{P_o^m} + (g_o^m - g_o) - (w_o^m - w_o)$$

$$X_1' = \frac{D_1'^m}{P_1^m} + (g_1'^m - g_1') - (w_1'^m - w_1')$$

Then:

$$\frac{P_1}{P_o} = \frac{b_1'}{b_o} \cdot \frac{E_1'}{E_o} \cdot \frac{X_o}{X_1'}$$

Taking logs of both sides:

$$\ln P_1 - \ln P_o = \ln b_1' - \ln b_o + \ln E_1' - \ln E_o - (-\ln X_o + \ln X_1')$$

But:

$$\ln P_1 - \ln P_o \simeq \frac{P_1 - P_o}{P_o} \qquad \text{for small } \frac{P_1 - P_o}{P_o}$$ [48]

48 H. Thiel, Applied Economic Forcasting, Rand-McNally, Chicago, 1966, pp. 47-49.

$$\frac{P_1}{P_o} = 1 + (\frac{P_1}{P_o} - 1) = 1 + (\frac{P_1 - P_o}{P_o}) \qquad \ln(\frac{P_1}{P_o}) = \ln(1 + (\frac{P_1 - P_o}{P_o}))$$

$$\therefore \ln P_1 - \ln P_o = \ln(1 + (\frac{P_1 - P_o}{P_o}))$$

Using a Taylor series expansion the R.H.S. becomes:

$$\ln(1 + (\frac{P_1 - P_o}{P_o})) = \frac{P_1 - P_o}{P_o} - \frac{1}{2}(\frac{P_1 - P_o}{P_o})^2 + \ldots .$$

For all: $\left| \frac{P_1 - P_o}{P_o} \right| < 1$

Truncating after the first term R.H.S., because the higher order terms approach zero.

Then: $\ln P_1 - \ln P_o \simeq \frac{P_1 - P_o}{P_o}$

And:

$$\ln b_1' - \ln b_o \simeq \frac{b_1'-b_o}{b_o} \quad \text{for small } \frac{b_1'-b_o}{b_o}$$

$$\ln E_1' - \ln E_o \simeq \frac{E_1'-E_o}{E_o} \quad \text{for small } \frac{E_1'-E_o}{E_o}$$

$$-(\ln X_1' - \ln X_o) \simeq -\frac{X_1'-X_o}{X_o} \quad \text{for small } \frac{X_1'-X_o}{X_o}$$

Thus:

$$\frac{P_1-P_o}{P_o} \simeq \frac{b_1'-b_o}{b_o} + \frac{E_1'-E_o}{E_o} - \frac{X_1'-X_o}{X_o}$$

Or:

$$\frac{P_1-P_o}{P_o} = \frac{b_1'-b_o}{b_o} + \frac{E_1'-E_o}{E_o} - \frac{X_1'-X_o}{X_o} + e$$

And:

$$\frac{P_1}{P_o} - 1 = \frac{b_1'}{b_o} - 1 + \frac{E_1'}{E_o} - 1 - \frac{X_1'}{X_o} + 1 + e$$

$$\frac{P_1}{P_o} = \frac{b_1'}{b_o} + \frac{E_1'}{E_o} - \frac{X_1'}{X_o} + e$$

Substituting back for X_1' and X_o:

$$\frac{P_1}{P_o} = \frac{b_1'}{b_o} + \frac{E_1'}{E_o} - \left[\frac{\dfrac{D_1'^m}{P_1^m} + (g_1'^m - g_1') - (w_1'^m - w_1')}{\dfrac{D_o^m}{P_o^m} + (g_o^m - g_o) - (w_o^m - w_o)}\right] + e$$

In cross section analysis: $\frac{D_1^{'m}}{P_1^m}$, $\frac{D_o^m}{P_o^m}$, $g_1^{'m}$, and g_o^m are all constant.

In order to develop a polynomial expression for the 3^{rd} term R.H.S. in the variables $(w_1^{'m}-w_1^{'})$, $g_1^{'}$, g_o, and $(w_o^m-w_o)$, we shall use a Maclaurin series expansion. Therefore the 3^{rd} term R.H.S. can be rewritten with constant terms in[ ]s.

$$3^{rd} \text{ term R.H.S.} = \frac{\left[\frac{D_1^{'m}}{P_1^m} + g_1^{'m}\right] - g_1^{'} - (w_1^{'m}-w_1^{'})}{\left[\frac{D_o^m}{P_o^m} + g_o^m\right] - g_o - (w_o^m-w_o)}$$

Let:

$$k_o = \frac{D_o^m}{P_o^m} + g_o^m$$

$$k_1 = \frac{D_1^{'m}}{P_1^m} + g_1^{'m}$$

And:

$A_o = g_o$ $\qquad B_o = (w_o^m-w_o)$

$A_1 = g_1^{'}$ $\qquad B_1 = (w_1^{'m}-w_1^{'})$

Then:

$$3^{rd} \text{ term R.H.S.} = f(A_o, A_1, B_o, B_1) = \frac{k_1 - A_1 - B_1}{k_o - A_o - B_o}$$

$$\begin{aligned} f(A_o, A_1, B_o, B_1)\Big|_{\substack{A_o=o \\ A_1=o \\ B_o=o \\ B_1=o}} &= f(o,o,o,o) + \frac{\partial f}{\partial A_o}(o,o,o,o)A_o \\ &+ \frac{\partial f}{\partial A_1}(o,o,o,o)A_1 \\ &+ \frac{\partial f}{\partial B_o}(o,o,o,o)B_o \\ &+ \frac{\partial f}{\partial B_1}(o,o,o,o)B_1 \\ &+ \frac{1}{2}\frac{\partial^2 f}{\partial A_o^2}(o,o,o,o)A_o^2 \\ &+ \frac{1}{2}\frac{\partial^2 f}{\partial A_1^2}(o,o,o,o)A_1^2 \\ &+ \frac{1}{2}\frac{\partial^2 f}{\partial B_o^2}(o,o,o,o)B_o^2 \\ &+ \frac{1}{2}\frac{\partial^2 f}{\partial B_1^2}(o,o,o,o)B_2^2 + \ldots\ldots \end{aligned}$$

$$\frac{k_1 - A_1 - B_1}{k_o - A_o - B_o} = (k_1 - A_1 - B_1)(k_o - A_o - B_o)^{-1}$$

$$f(o) = \frac{k_1}{k_o}$$

$$\frac{\partial f}{\partial A_o} = -1(-1)(k_o-A_o-B_o)^{-2}(k_1-A_1-B_1) = +\frac{k_1}{(k_o)^2}$$

$$\frac{\partial f}{\partial A_1} = (-1)(k_o-A_o-B_o)^{-1} = -\frac{1}{k_o}$$

$$\frac{\partial f}{\partial B_o} = +1(k_o-A_o-B_o)^{-2}(k_1-A_1-B_1) = \frac{k_1}{(k_o)^2}$$

$$\frac{\partial f}{\partial B_1} = -1(k_o-A_o-B_o)^{-1} = -\frac{1}{k_o}$$

$$f(A_o,A_1,B_o,B_1)\Big|_{\substack{A_o=o\\A_1=o\\B_o=o\\B_1=o}} = \frac{k_1}{k_o} + \frac{k_1}{(k_o)^2}A_o - \frac{A_1}{k_o} + \frac{k_1}{(k_o)^2}B_o - \frac{B_1}{k_o}$$

$$\text{Then } 3^{rd} \text{ term R.H.S.} = \frac{\frac{D_1^{'m}}{P_1^m} + g_1^{'m}}{\frac{D_o^m}{P_o^m} + g_o^m} + \frac{(\frac{D_1^{'m}}{P_1^m} + g_1^{'m})g_o}{(\frac{D_o^m}{P_o^m} + g_o^m)^2} - \frac{g_1^{'}}{(\frac{D_o^m}{P_o^m} + g_o^m)}$$

$$+ \frac{(\frac{D_1^{'m}}{P_1^m} + g_1^{'m})(w_o^m-w_o)}{(\frac{D_o^m}{P_o^m} + g_o^m)^2} - \frac{(w_1^{'m}-w_1^{'})}{\frac{D_o^m}{P_o^m} + g_o^m}$$

Thus:

$$\frac{P_1}{P_o} = \frac{b_1'}{b_o} + \frac{E_1'}{E_o} - \frac{\left(\frac{D_1'^m}{P_1^m} + g_1'^m\right)}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)} - \frac{\left(\frac{D_1'^m}{P_1^m} - g_1'^m\right)}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)^2} g_o + \frac{g_1'}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)}$$

$$- \frac{\left(\frac{D_1'^m}{P_1^m} + g_1'^m\right) (w_o^m - w_o)}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)^2} + \frac{w_1'^m - w_1'}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)} + e$$

But:

$$k_{eo}^m = \frac{D_o^m}{P_o^m} + g_o^m$$

Likewise:

$$k_{e1}^m = \frac{D_1'^m}{P_1^m} + g_1'^m$$

Substituting for $\frac{D_1'^m}{P_1^m} + g_1'^m$ and $\frac{D_o^m}{P_o^m} + g_o^m$:

$$\frac{P_1}{P_o} = \frac{b_1'}{b_o} + \frac{E_1'}{E_o} - \left(\frac{k_{e1}^m}{k_{eo}^m}\right) - \frac{(k_{e1}^m)}{(k_{eo}^m)^2} g_o + \frac{g_1'}{k_{eo}^m} - \frac{k_{e1}^m}{(k_{eo}^m)^2} (w_o^m - w_o)$$

$$+ \frac{w_1'^m - w_1'}{(k_{eo}^m)} + e$$

Multiplying the 5^{th} and 7^{th} term R.H.S. by $\frac{k^m_{eo}}{k^m_{eo}}$:

$$\frac{P_1}{P_o} = \frac{b_1'}{b_o} + \frac{E_1'}{E_o} - \frac{k^m_{e1}}{k^m_{eo}} - \frac{(k^m_{e1})}{(k^m_{eo})^2}\, g_o + \frac{k^m_{eo} g_1'}{(k^m_{eo})^2} - \frac{(k^m_{e1})(w^m_o - w_o)}{(k^m_{eo})^2}$$

$$+ \frac{k^m_{eo}(w_1'^m - w_1')}{(k^m_{eo})^2} + e$$

Combining terms:

$$\frac{P_1}{P_o} = \frac{b_1'}{b_o} + \frac{E_1'}{E_o} - \frac{k^m_{e1}}{k^m_{eo}} - \frac{k^m_{e1} g_o - k^m_{eo} g_1'}{(k^m_{eo})^2}$$

$$- \frac{k^m_{e1}(w^m_o - w_o) - k^m_{eo}(w_1'^m - w_1')}{(k^m_{eo})^2} + e$$

The economic significance of each of these terms is as follows:

$\frac{b_1'}{b_o}$: If the ratio of the current period TANNE dividend payout ratio increases relative to the previous period's historical-dollar accounting dividend payout ratio then the relative price per share increases.

$\frac{E_1'}{E_o}$: If the ratio of TANNE per share to historical-dollar accounting earnings per share increases then the relative price per share increases.

$-\dfrac{k^m_{e1}}{k^m_{eo}}$: If the relative cost of equity capital for the market as a whole increases then the relative price per share decreases.

$-\dfrac{k^m_{e1}g_o-k^m_{eo}g_1'}{(k^m_{eo})^2}$: This is an interactive term. For a constant expected dividend growth rate for the firm, i.e. $g_1' = g_o$.

Then:

$$-g_1' \frac{(k^m_{e1}-k^m_{eo})}{(k^m_{eo})^2}$$

So that if the cost of equity capital for the market as a whole increases the relative price per share decreases, not only by the amount of the increase in k^m_{e1}, but also by a factor of:

$$\frac{1}{(k^m_{eo})^2} \;.$$

Similarily for a constant cost of equity capital for the market as a whole, i.e. $k^m_{e1} = k^m_{eo}$.

Then:

$$-\frac{k^m_{eo}(g_o-g_1')}{(k^m_{eo})^2} = -\frac{g_o-g_1'}{k^m_{eo}}$$

So that if the expected dividend growth rate increases, the relative price per share increases not only by the amount of the increase in the expected rate of dividend growth, but also by a factor of:

$(\frac{1}{k^m_{eo}})$.

It should be noted that an increase in the cost of equity capital will have a greater effect on the relative price per share than an increase in the expected dividend growth rate because:

$$\frac{1}{(k^m_{eo})^2} > \frac{1}{(k^m_{eo})} \quad \text{since } k^m_{eo} < 1.0.$$

$-\dfrac{k^m_{e1}(w^m_o - w_o) - k^m_{eo}(w_1'^m - w_1')}{(k^m_{eo})^2}$: This is an interactive term. For a constant relative risk premium for the firm to the risk premium for the market as a whole, i.e. $w^m_o - w_o = w_1'^m - w_1'$

Then:

$$-\frac{(w_1'^m - w_1')(k^m_{e1} - k^m_{eo})}{(k^m_{eo})^2}$$

So that if the cost of equity capital for the market as a whole increases the relative price per share decreases, not only by the amount of the increase in k^m_{e1}, but also by a factor of:

$$\frac{1}{(k^m_{eo})^2}$$

Similarily for a constant cost of equity capital for the market as a whole, i.e. $k^m_{e1} = k^m_{eo}$

Then:

$$-\frac{k^m_{eo}((w^m_o - w_o) - (w_1'^m - w_1'))}{(k^m_{eo})^2}$$

So that if the risk premium for the firm relative to the risk premium for the market as a whole increases the relative price per share decreases not only by the amount of the increase in the risk premium of the firm relative to the risk premium of the market as a whole, but also by a factor of:

$$\frac{1}{k_{eo}^{m}}$$

In order to specify the model, substitute:

$$\frac{D_o^m}{P_o^m} + g_o^m = k_{eo}^m$$

$$\frac{D_1^{'m}}{P_1^m} + g_1^{'m} = k_{e1}^m$$

$$\frac{P_1}{P_o} = \frac{b_1^{'}}{b_o} + \frac{E_1^{'}}{E_o} - \frac{\left(\frac{D_1^{'m}}{P_1^m} + g_1^{'m}\right)}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)} - \frac{\left(\frac{D_1^{'m}}{P_1^m} + g_1^{'m}\right)}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)^2} g_o + \frac{g_1^{'}}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)}$$

$$- \frac{\left(\frac{D_1^{'m}}{P_1^m} + g_1^{'m}\right)(w_o^m - w_o)}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)^2} + \frac{(w_1^{'m} - w_1^{'})}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)} + e$$

Substituting for $E_1^{'}$ from Chapter III:

$$E_1^{'} = E_1 - DR_1 \sum_{i=o}^{-\infty} \left\{ \left[\frac{CS_i}{I_i}\right] \left[(K_1 I_o)(1 - \sum_{h=o}^{i} B_h) - B_{1-i}(I_o(1+K_1) - I_i) \right] \right\}$$

$$- V_1(K_1)(1 - \frac{1}{2T_1}) IN_o + (r_r + K_1) M_o$$

Then:

$$\frac{P_1}{P_o} = \frac{b_1^{'}}{b_o} + \frac{E_1}{E_o}$$

$$- \frac{DR_1}{E_o} \sum_{i=o}^{-\infty} \left(\left\{ \left[\frac{CS_i}{I_i} \right] \left[(K_1 I_o)(1 - \sum_{h=o}^{i} B_h) - B_{1-i}(I_o(1+K_1) - I_i \right] \right\} \right)$$

$$- V_1(K_1)(1 - \frac{1}{2T_1}) \frac{IN_o}{E_o} + (r_r + K_1) \frac{M_o}{E_o}$$

$$- \frac{\left(\frac{D_1^{'m}}{P_1^m} + g_1^{'m}\right)}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)} - \frac{\left(\frac{D_1^{'m}}{P_1^m} + g_1^{'m}\right)}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)^2} g_o + \frac{g_1^{'}}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)}$$

$$- \frac{\left(\frac{D_1^{'m}}{P_1^m} + g_1^{'m}\right)}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)^2} (w_o^m - w_o) + \frac{(w_1^{'m} - w_1^{'})}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)} + e$$

In the 5^{th} term R.H.S.:

$$r^{'} = r_r + K_1$$

And:

$$\bar{m}_p = r_r + \bar{K}_p$$

Then:

$$r_r = \bar{m}_p - \bar{K}_p$$

So that:

$$r' = \bar{m}_p + K_1 - \bar{K}_p$$

Thus:

$$(r_r + K_1)\frac{M_o}{E_o} = \bar{m}_p\left(\frac{M_o}{E_o}\right) + (K_1 - \bar{K}_p)\frac{M_o}{E_o}$$

Thus we postulate the following:

$$\frac{P_1}{P_o} = \beta_o + \beta_1\left[\frac{b_1'}{b_o}\right] + \beta_2\left[\frac{E_1}{E_o}\right]$$

$$- \beta_3\left[\frac{DR_1}{E_o}\sum_{i=o}^{-\infty}\left\{\left[\frac{CS_i}{I_i}\right]\left[(K_1 I_o)\left(1 - \sum_{h=o}^{i} B_h\right) - B_{1-i}(I_o(1+K_1) - I_i)\right]\right\}\right]$$

$$- \beta_5\left[V_1(K_1)\left(1 - \frac{1}{2T_1}\right)\frac{IN_o}{E_o}\right] + \beta_6\left[\bar{m}_p\left(\frac{M_o}{E_o}\right)\right] + \beta_7\left[(K_1 - \bar{K}_p)\frac{M_o}{E_o}\right]$$

$$- \beta_8\left[\frac{\frac{D_1'^m}{P_1^m} + g_1'^m}{\frac{D_o^m}{P_o^m} + g_o^m}\right] - \beta_9\left[\frac{\left(\frac{D_1'^m}{P_1^m} + g_1'^m\right)}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)^2} g_o\right] + \beta_{10}\left[\frac{g_1'}{\frac{D_o^m}{P_o^m} + g_o^m}\right]$$

$$- \beta_{11}\left[\frac{\left(\frac{D_1'^m}{P_1^m} + g_1'^m\right)}{\left(\frac{D_o^m}{P_o^m} + g_o^m\right)^2}(w_o^m - w_o)\right] + \beta_{12}\left[\frac{w_1'^m - w_1'}{\frac{D_o^m}{P_o^m} + g_o^m}\right] + e$$

In the 2^{nd} term R.H.S. multiply by $\frac{b_1}{b_1}$

$$\beta_1 \left[\frac{b_1^{'}}{b_o}\right] = \beta_1 \left[\left(\frac{b_1^{'}}{b_1}\right)\left(\frac{b_1}{b_o}\right)\right]$$

Then let:

$$\beta_1^{'} = \beta_1\left(\frac{b_1^{'}}{b_1}\right) \text{ where } \frac{b_1^{'}}{b_1} \text{ is a scaling constant.}$$

In the 4^{th} term R.H.S.

In order to evaluate the proxy for the underdepreciation of real fixed assets when historical-dollar accounting and general price-level accounting depreciation are compared, we have employed a Lagrangian interpolation technique to estimate the lagged coefficients for this term.[49] In:

$$\frac{DR_1}{E_o} \sum_{i=o}^{-\infty} \left\{ \left[\frac{CS_i}{I_i}\right] \left[K_1 I_o\right] \left[\left(1 - \sum_{h=o}^{i} B_h\right) - B_{1-i}\left(I_o(1+K_1) - I_i\right)\right] \right\}$$

$$\text{Let } \gamma_{-i} = \left[\left(1 - \sum_{h=o}^{i} B_h\right) - B_{1-i}\left(I_o(1+K_1) - I_i\right)\right]$$

49 S. Almon, "The Distributional Lag Between Capital Appropriations and Expenditures," Econometrica, (Jan. 1965), pp. 178-196.

Then:

$$\frac{DR_1}{E_o}\sum_{i=o}^{-\infty}\left\{\left[\frac{CS_i}{I_i}\right]\left[(K_1 I_o)(1-\sum_{h=o}^{i} B_h)-B_{1-i}(I_o(1+K_1)-I_i)\right]\right\} =$$

$$\sum_{i=o}^{-\infty}\gamma_{-i}\left[\frac{CS_i}{I_i}\right]\left[K_1 I_o\right]\left[\frac{DR_1}{E_o}\right]$$

Assuming $\gamma_i = 0$: for all $i < -10$

Construct 2^{nd} Degree Lagrangian interpolation polynomials:

$\phi\ (-i,j)$ where: $i = 0, \ldots, -10$

$j = 1,2$

Such that:

$$\gamma_{-i} = \beta_3\ \phi\ (-i,1) + \beta_4\ \phi\ (-i,2)$$

Then:

$$\frac{DR_1}{E_o}\sum_{i=o}^{-\infty}\gamma_{-i}\left[\frac{CS_i}{I_i}\right]\left[K_1 I_o\right] = \sum_{i=o}^{-10}\left[\beta_3\ \phi\ (-i,1) + \beta_4\ \phi\ (-i,2)\right]\left[(\frac{CS_i}{I_i})(K_1 I_o)(\frac{DR_1}{E_o})\right]$$

The R.H.S. can be rewritten:

$$\beta_3\sum_{i=o}^{-10}\phi\ (-i,1)(\frac{CS_i}{I_i})(K_1 I_o)(\frac{DR_1}{E_o})$$

$$+\beta_4\sum_{i=o}^{-10}\phi\ (-i,2)(\frac{CS_i}{I_i})(K_1 I_o)(\frac{DR_1}{E_o})$$

Let:

$$Z_1 = \sum_{i=o}^{-10} \phi\ (-i,1)(\frac{CS_i}{I_i})(K_1 I_o)(\frac{DR_1}{E_o})$$

and

$$Z_2 = \sum_{i=o}^{-10} \phi\ (-i,2)(\frac{CS_i}{I_i})(K_1 I_o)(\frac{DR_1}{E_o})$$

Z_1 and Z_2 are the variables which are entered into the regression equation. The $\phi\ (-i,j)$ are constructed according to formula in Almon,[50] and the other elements in Z_1 and Z_2 are available from our data sources.

In the 8^{th} term R.H.S., if we assume homogeneity of investor expectations about $\bar{K}_p$, the previously anticipated future rate of inflation, then in cross section analysis $K_1-\bar{K}_p$ will be a constant.

Then let:

$$\beta_7' = \beta_7(K_1-\bar{K}_p)$$

In the 9^{th}, 10^{th}, 11^{th}, 12^{th} and 13^{th} terms.

$\frac{D_o^m}{P_o^m} + g_o^m$ and $\frac{D_1'^m}{P_1^m} + g_1'^m$ will be constants in cross section analysis.

50 <u>Ibid</u>.

Then let:

$$\beta'_8 = \beta_8 \frac{\left(\dfrac{D_1'^m}{P_1^m} + g_1'^m\right)}{\left(\dfrac{D_o^m}{P_o^m} + g_o^m\right)}$$

$$\beta'_9 = \beta_9 \frac{\left(\dfrac{D_1'^m}{P_1^m} + g_1'^m\right)}{\left(\dfrac{D_o^m}{P_o^m} + g_o^m\right)^2}$$

$$\beta'_{10} = \beta_{10} \frac{1}{\left(\dfrac{D_o^m}{P_o^m} + g_o^m\right)}$$

$$\beta'_{11} = \beta_{11} \frac{\left(\dfrac{D_1'^m}{P_1^m} + g_1'^m\right)}{\left(\dfrac{D_o^m}{P_o^m} + g_o^m\right)^2}$$

$$\beta'_{12} = \beta_{12} \frac{1}{\left(\dfrac{D_o^m}{P_o^m} + g_o^m\right)}$$

Then:

$$\frac{P_1}{P_o} = \beta_o + \beta_1'\left[\frac{b_1}{b_o}\right] + \beta_2\left[\frac{E_1}{E_o}\right] - \beta_3\left[\sum_{i=o}^{-10} \phi\ (-i,1)\left(\frac{CS_i}{I_i}\right)(K_1 I_o)\left(\frac{DR_1}{E_o}\right)\right]$$

$$-\beta_4\left[\sum_{i=o}^{-10} \phi\ (-i,2)\left(\frac{CS_i}{I_i}\right)(K_1 I_o)\left(\frac{DR_1}{E_o}\right)\right]$$

$$-\beta_5\left[V_1(K_1)\left(1 - \frac{1}{2T_1}\right)\left(\frac{IN_o}{E_o}\right)\right] + \beta_6\left[\bar{m}_p\left(\frac{M_o}{E_o}\right)\right] + \beta_7'\left[\frac{M_o}{E_o}\right]$$

$$-\beta_8'\left[1\right] - \beta_9'\left[g_o\right] + \beta_{10}'\left[g_1'\right] - \beta_{11}'\left[w_o^m - w_o\right] + \beta_{12}'\left[w_1'^m - w_1'\right] + e$$

We have no a priori reasons to believe that the basic assumptions underlying ordinary least squares regressions are not satisfied.

1. That the disturbance term e_i is normally distributed.
2. That the expected value of e_i is equal to zero.
3. That every e_i has the same variance.
4. That e_i and $e_j (i \neq j)$ are not correlated.
   $E(e_i, e_j) = 0$
5. That the values for the X_i are fully predictable.

SUMMARY

A price relative regression model has been formulated which will isolate the effects of a firm's: relative dividend payout ratio, relative historical-dollar earnings, underdepreciation of fixed assets when historical-dollar accounting is contrasted with general price-level adjusted accounting per dollar of earnings, inventory holding gains per dollar of earnings, net-monetary debtor position per dollar of earnings, expected dividend growth rate, risk premium relative to that of the market as a whole.

In Chapter V, ordinary least squares multiple regression will be employed to estimate the coefficients of the model.

CHAPTER V

TESTING THE PRICE RELATIVE REGRESSION MODEL

SOURCE AND SELECTION OF DATA

The Standard and Poor's Annual Primary Industrial File, COMPUSTAT tape was the source for all financial data for individual firms, except for risk and share price information. These data items were obtained from THE VALUE LINE INVESTMENT SURVEY, "Summary of Advices and Index". The inflation rate is based upon the Consumer Price Index for "all items for city wage earners and clerical workers"; published by the U.S. Department of Labor, Bureau of Labor Statistics.

The years chosen for this study were 1965 and 1972. 1965 had an inflation rate of 1.67 percent based upon the Consumer Price Index (C.P.I.), and relative stock market increase of 8.46 percent based upon the Standard and Poors 425 Industrial Index (S&P-425). This year represents the last year of a period of relative price stability. The mean annual change in the C.P.I. for the six previous years was less than 1.19 percent.

1972 represents the most recent year for which the complete COMPUSTAT tape was available. In this year, the inflation rate was 3.26 percent based upon the C.P.I. and the stock market increased 12.4 percent based upon the S&P-425. Further, 1972 came at the end of a six year period in which the mean annual rate of change in the C.P.I. exceeded 4.32 percent, and thus investors had experienced a considerable period of time over which to readjust their expectations of stock price appreciation based upon a significantly higher rate of inflation.

The firms in this study consisted of unregulated manufacturing firms. Thus the following industries were eliminated from the study: government regulated or dependant (i.e. Aerospace), service and entertainment, financial, building, publishing, agricultural, and wholesale and retail trade. The Value Line Investment Survey had risk class and share price data on 935 firms for 1965. When these firms were matched to the individual firm data on COMPUSTAT the number of firms was reduced to 393. Further screens were employed on these firms so that the computed inputs to the regression equation would be both meaningful and stay within the range of computation.

The following screens were employed to eliminate firms:

$b_o \leq 0$	$t_1 \geq 1$	$\bar{m}_p \geq 1$
$b_1 \leq 0$	$E_o \leq 0$	$\frac{E_1}{E_o}$ out of range
$t_1 \leq 0$	$B_o \leq 0$	$T_1 > .5$

As a result of these criteria 240 firms were used in the 1965 regressions, while 214 firms were used in the 1972 tests.

PROCEDURE

The regression equation to be estimated is:

$$
\begin{aligned}
\frac{P_1}{P_o} = {} & \beta_o + \beta_1^{'}\left[\frac{b_1}{b_o}\right] + \beta_2\left[\frac{E_1}{E_o}\right] - \beta_3\left[\sum_{i=o}^{-10} \phi\,(-i,1)\left(\frac{CS_i}{I_i}\right)(K_1 I_o)\left(\frac{DR_1}{E_o}\right)\right] \\
& - \beta_4\left[\sum_{i=o}^{-10} \phi\,(-i,2)\left(\frac{CS_i}{I_i}\right)(K_1 I_o)\left(\frac{DR_1}{E_o}\right)\right] \\
& - \beta_5\left[V_1(K_1)\left(1 - \frac{1}{2T_1}\right)\frac{IN_o}{E_o}\right] + \beta_6\left[\bar{m}_p\left(\frac{M_o}{E_o}\right)\right] + \beta_7^{'}\left[\frac{M_o}{E_o}\right] - \beta_8^{'}\left[1\right] \\
& - \beta_9^{'}\left[g_o\right] + \beta_{10}^{'}\left[g_1^{'}\right] - \beta_{11}^{'}\left[w_o^m - w_o\right] + \beta_{12}^{'}\left[w_1^{'m} - w_1^{'}\right] + e
\end{aligned}
$$

Since the net-monetary debtor leverage variables $\bar{m}_p\left(\frac{M_o}{E_o}\right)$ and $\frac{M_o}{E_o}$ are highly colinear, we were forced to drop one of these two variables in order to estimate the regressions. It was decided to retain $\bar{m}_p(\frac{M_o}{E_o})$ since this variable includes $\bar{m}_p$, the embedded money rate of interest.

In cross section analysis $\beta_\delta'[1]$ will be incorporated into the constant term of the regression, so it too was dropped from the analysis.

The expected dividend growth rate, as perceived the previous year, g_o, was proxied by the actual dividend growth rate experienced over the last five years ending with the previous year. Similarily, the expected dividend growth rate, as perceived during the current year, g_1', was proxied by the actual dividend growth rate experienced over the last five years ending with the current year. Since these are overlapping moving averages, the simple correlation coefficient between g_o and g_1' should be high. In fact in 1965 it was .674 and in 1972 it was .735. Thus, it is highly likely under this condition that either one or both of the estimated coefficients of these variables will not be significant.

The relative risk of the firm to that of the market as a whole for the previous year, $w_o^m - w_o$, and that for the current year, $w_1'^m - w_1'$, were proxied using Value Lines's five risk class estimates. In accordance with Value Line's classification each firm was assigned a rating of 1, 2, 3, 4, 5. Thus the proxy was measured by the deviation of the firm's assigned risk rating from 3, the risk rating assigned to the market as a whole.

Thus the equation upon which the regressions were run is:

$$\frac{P_1}{P_0} = \beta_0 + \beta_1'\left[\frac{b_1}{b_0}\right] + \beta_2\left[\frac{E_1}{E_0}\right] + \beta_3\left[\sum_{i=0}^{-10} \emptyset(-i,1)\left(\frac{CS_i}{I_i}\right)(K_1 I_0)\left(\frac{DR_1}{E_0}\right)\right]$$

$$+\beta_4\left[\sum_{i=0}^{-10} \emptyset(-i,2)\left(\frac{CS_i}{I_i}\right)(K_1 I_0)\left(\frac{DR_1}{E_0}\right)\right]$$

$$+\beta_5\left[V_1(K_1)\left(1 - \frac{1}{2T_1}\right)\frac{IN_0}{E_0}\right] + \beta_6\left[\bar{m}_p\left(\frac{M_0}{E_0}\right)\right] + \beta_9'\left[g_0\right]$$

$$+\beta_{10}'\left[g_1'\right] + \beta_{11}'\left[w_0^m - w_0\right] + \beta_{12}'\left[w_1'^m - w_1'\right] + e$$

P_0: Price per share of common stock for the previous year.

P_1: Price per share of common stock for the current year.

b_0: The dividend payout ratio for the previous year, based upon historical-dollar accounting $b_0 = \frac{D_0}{E_0}$.

b_1: The dividend payout ratio for the current year, based upon historical-dollar accounting $b_1 = \frac{D_1}{E_1}$.

E_0: The historical-dollar accounting earnings in the previous year.

E_1: The historical-dollar accounting earnings in the current year.

$\bar{m}_p$: The embedded money rate of interest.

K_1: The actual inflation rate in the current period.

I_0: The C.P.I. value in the previous period.

I_i: The C.P.I. value in the i^{th} period.

CS_i: The capital spending in the i^{th} period.

DR_1: The depreciation rate in the current period, based upon historical-dollar accounting.

V_1: A dummy variable such that $V_1 = 0$ if LIFO

$V_1 = 1$ if FIFO

T_1: Inventory turnover rate.

IN_0: The dollar amount of inventories for the previous period.

M_0: Net monetary debtor position for the previous period.

g_0: The expected dividend growth rate as perceived during the previous year.

g_1': The expected dividend growth rate as perceived during the current year.

$w_0^m - w_0$: The relative risk of the firm to that of the market as a whole as perceived during the previous year, where: w_0^m represents the risk of the market and w_0 represents the risk of the individual firm.

$w_1'^m - w_1'$: The relative risk of the firm to that of the market as a whole as perceived during the current year.

RESULTS OF THE STUDY

The most significant regression results are reported in Table 1.

The R^2 values, while low, are not unusually low for cross section analysis. The full regression model, Eq. VI, has an R^2 = .3406 for 1965 and an R^2 = .2950 for 1972.

In 1965 Eq. I, which represents the relationship between the relative stock prices and the relative historical-dollar accounting dividend payout ratios plus the relative historical-dollar accounting earnings, has an R^2 = .1936. Eq. VI, which is the full model, has an R^2 = .3406. Thus the relative dividend payout ratios plus relative historical-dollar accounting earnings are responsible for 57 percent of the total explained variance in relative stock prices during 1965.

In 1972 Eq. I has an R^2 = .1135, as compared to Eq. VI which has an R^2 = .2950, was responsible for only 38 percent of the total explained variance in relative stock prices that year.

From a different point of view the additional explanatory variables of Eq. VI, as compared to Eq. I, were responsible for only 43 percent of the explained variance in relative stock prices during 1965, while in a period of relatively high inflation, 1972, these additional variables were responsible for 62 percent of the explained variance in relative stock prices.

		b_0	Dividend Payout Ratio	Historical Growth in Earnings	[illegible]	[illegible] Growth Rate	[illegible] Growth Rate	[illegible]	[illegible]	[illegible]	[illegible]	Net Monetary [illegible]	R^2	Standard Error of Estimate
Eq I	1965	-.15[illegible]	-.[illegible]	.[illegible]									[illegible]	[illegible]
		(-1.8[illegible])	(-1.4[illegible])	(2.[illegible])										
	1972	.1457	-.1[illegible]	.0571									[illegible]	[illegible]
		(3.5284)	-[illegible]	([illegible])										
Eq II	1965	-.1469	-.2021	[illegible]	[illegible]								[illegible]	[illegible]
		(-1.6133)	-1.[illegible]	(3.[illegible])	(4.[illegible])									
	1972	.2221	-.1579	[illegible]	-[illegible]								[illegible]	[illegible]
		(2.69[illegible])	(-3.7713)	([illegible])	(-[illegible])									
Eq III	1965	-.1772	-.1476	.4555	[illegible]	[illegible]	-.1[illegible]						[illegible]	[illegible]
		(-1.7815)	(-1.1722)	(5.[illegible])	[illegible]	[illegible]	-[illegible]							
	1972	.2074	-.1[illegible]	[illegible]	-[illegible]	[illegible]	-.1[illegible]						[illegible]	[illegible]
		(2.5025)	(-3.4[illegible])	(2.[illegible])	(-[illegible])	[illegible]	-[illegible]							
Eq IV	1965	-.1331	-.0716	.3[illegible]	[illegible]	.1[illegible]	-.[illegible]	-.[illegible]	[illegible]				[illegible]	[illegible]
		(-1.2994)	(-1.3505)	([illegible])	(-[illegible])	[illegible]	-[illegible]	-[illegible]	[illegible]					
	1972	.1316	-.1495	.1[illegible]	-.[illegible]	[illegible]	-[illegible]	-[illegible]	.1111				[illegible]	[illegible]
		([illegible])	(-3.0035)	(3.[illegible])	(-1.[illegible])	1.[illegible]	-1.[illegible]	([illegible])	[illegible]					
Eq V	1965	-.1434	-.0221	.[illegible]	1.[illegible]	-.[illegible]	[illegible]	-.[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
		(-1.4312)	(-1.[illegible])	(4.5126)	[illegible]	-[illegible]	[illegible]	-[illegible]	[illegible]	[illegible]	[illegible]			
	1972	.1220	-.1422	.1[illegible]	-.[illegible]	.[illegible]	-.[illegible]	-.[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
		[illegible]	(-2.[illegible])	(3.[illegible])	(-[illegible])	1.[illegible]	-1.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
Eq VI	1965	-.1361	-.1[illegible]	.3[illegible]	[illegible]	-.[illegible]	.11[illegible]	-.[illegible]	[illegible]	[illegible]	[illegible]	-.[illegible]	[illegible]	[illegible]
		(-1.3541)	-1.[illegible]	[illegible]	[illegible]	-.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	(-1.[illegible])		
	1972	.0125	-.1[illegible]	[illegible]	-.[illegible]	[illegible]	-.[illegible]	-.[illegible]	[illegible]	[illegible]	[illegible]	-.[illegible]	[illegible]	[illegible]
		[illegible]	-2.[illegible]	[illegible]	-1.[illegible]	1.[illegible]	-1.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		

Analysis of the Coefficients of the Individual Variables

The constant term, β_o, is consistently negative in the 1965 regressions and is statistically significant at the 5 percent level in only one of the six regressions. While in the 1972 regressions the constant term is consistently positive and significant at the 5 percent level in three of the six regressions.

β_1', the coefficient of the relative historical-dollar accounting payout ratio, $\frac{D_1/E_1}{D_o/E_o}$, is consistently negative for both years. In 1965 it is significant at the 5 percent level in only two of the six regressions, while in 1972 it is significant in all six regressions.

β_2, the coefficient of the relative historical-dollar accounting earnings, $\frac{E_1}{E_o}$, is positive and significant at the 5 percent level in both years for all regressions.

Linear combinations of β_3 and β_4 generate the γ_{-i}'s, the proxy variables for the difference between historical-dollar accounting and general price-level adjusted accounting depreciation, Thus,

$$\sum_{i=o}^{-10} \phi\,(-i,1)\left(\frac{CS_i}{I_i}\right)(K_1 I_o)\left(\frac{DR_1}{E_o}\right) \text{ and}$$

$$\sum_{i=o}^{-10} \phi\,(-i,2)\left(\frac{CS_i}{I_i}\right)(K_1 I_o)\left(\frac{DR_1}{E_o}\right),$$

must be treated as a joint addition to the regression.

The hypothesis that they are jointly equal to zero was investigated, because if we are unable to reject the hypothesis that $\beta_3 = \beta_4 = 0$ then we cannot reject the hypothesis that $\gamma_{-i} = 0$ for $i = 0, \ldots, 10$.

Since the 1965 test statistic falls in the rejection region there is sufficient evidence to indicate that the joint addition of the proxies for the difference between historical-dollar accounting and general price-level adjusted depreciation contribute significantly, at the 5 percent level, to the regressions.

Since the 1972 test statistic does not fall in the rejection region there is no evidence to indicate that the joint addition of the proxies for the difference between historical-dollar accounting and general price-level adjusted depreciation contribute significantly, at the 5 percent level, to the regressions.

Table 2

ANALYSIS OF VARIANCE

Test of the hypothesis that $\beta_3 = \beta_4 = 0$ for 1965

	Sum of Squares	Degrees of Freedom	Mean Squares	F
Total (Restricted)	28.766168	232	.123992	
Regression (Unrestricted)	26.819979	230	.116609	
Error	1.946189	2	.973095	8.344935

$F_{2,230} \simeq 3.04$

TABLE 3

ANALYSIS OF VARIANCE

Test of the hypothesis that $\beta_3 = \beta_4 = 0$ for 1972

	Sum of Squares	Degrees of Freedom	Mean Squares	F
Total (Restricted)	10.051386	206	.048793	
Regression (Unrestricted)	9.986141	204	.048952	
Error	.065245	2	.032623	.666418

$F_{2,204} \simeq 3.04$

β_5, the coefficient of the proxy for inventory gains, $V_1(K_1)(1 - \frac{1}{2T_1})\frac{IN_o}{E_o}$, is consistently positive and significant at the 5 percent level in all of the 1965 regressions. While in 1972 the coefficient is negative and significant at the 5 percent level for all regressions.

β_6, the coefficient of the proxy for net-monetary debtor leveraging of earnings, $\bar{m}_p(\frac{M_o}{E_o})$, is negative in 1965 and not significant at the 5 percent level. While, in 1972, it is negative but significant at the 5 percent level.

β_9', the coefficient of the proxy for the previous year's expectations about the future dividend growth rate, g_o, has mixed signs and lacks significance at the 5 percent level in all of the 1965 regressions. In 1972 the coefficient is consistently positive, but it is only significant at the 5 percent level in one of the six regressions.

β_{10}', the coefficient of the proxy for the current year's expectations about the future dividend growth rate, g_1', has mixed signs and lacks significance at the 5 percent level in the 1965 regressions. While in 1972 it is consistently negative and it also lacks significance at the 5 percent level. These data bear out the previously expressed concern about these overlapping moving averages.

Since the estimated coefficients of the proxies, g_0 and g_1', for the expected future dividend growth rate are not significant at the 5 percent level, the hypothesis that these coefficients are jointly equal to zero was investigated. The results of these tests are tabulated in Tables 4 and 5. Both the 1965 and 1972 test statistics do not fall in the rejection region, thus there is no evidence to indicate that the joint addition of g_0 and g_1' contribute significantly, at the 5 percent level, to the regressions.

TABLE 4

ANALYSIS OF VARIANCE

Test of the hypothesis that $\beta_9' = \beta_{10}' = 0$ for 1965

	Sum of Squares	Degrees of Freedom	Mean Squares	F
Total (Restricted)	29.658193	236	.125670	
Regression (Unrestricted)	29.567600	234	.126357	
Error	.090593	2	.045297	.358480

$F_{2,234} \simeq 3.04$

TABLE 5

ANALYSIS OF VARIANCE

Test of the hypothesis that $\beta_9' = \beta_{10}' = 0$ for 1972

	Sum of Squares	Degrees of Freedom	Mean Squares	F
Total (Restricted)	11.381119	210	.054196	
Regression (Unrestricted)	11.336787	208	.054504	
Error	.044332	2	.022166	.406686

$F_{2,208} \simeq 3.04$

β_{11}', the coefficient of the proxy for the previous year's relative risk of the firm to that of the market as a whole, $w_o^m - w_o$, is consistently negative and significant at the 5 percent level in all of the 1965 regressions. In the 1972 regressions it was consistently negative, but without significance at the 5 percent level.

β'_{12}, the coefficient of the proxy for the current year's relative risk of the firm to that of the market as a whole, $w_1'^m - w_1'$, is consistently positive and not significant at the 5 percent level in both the 1965 and 1972 regressions.

Since the estimated coefficients of the proxies, $w_o^m - w_o$ and $w_1'^m - w_1'$, are of mixed significance the hypothesis that these coefficients are jointly equal to zero was investigated. The results of these tests are tabulated in Tables 6 and 7. Both the 1965 and 1972 test statistics fall in the rejection region. Thus there is sufficient evidence to indicate that the joint addition of $w_o^m - w_o$ and $w_1'^m - w_1'$ contribute significantly, at the 5 percent level, to the regressions.

TABLE 6

ANALYSIS OF VARIANCE

Test of the hypothesis $\beta'_{11} = \beta'_{12} = 0$ for 1965

	Sum of Squares	Degrees of Freedom	Mean Squares	F
Total (Restricted)	29.567600	234	.126357	
Regression (Unrestricted)	28.766168	232	.123992	
Error	.801432	2	.400716	3.231789

$F_{2,232} \simeq 3.04$

TABLE 7

ANALYSIS OF VARIANCE

Test of the hypothesis $\beta'_{11} = \beta'_{12} = o$ for 1972

	Sum of Squares	Degrees of Freedom	Mean Squares	F
Total (Restricted)	11.336787	208	.054504	
Regression (Unrestricted)	10.051386	206	.048793	
Error	1.285401	2	.642701	13.171962

$F_{2,206} \simeq 3.04$

INTERPRETATION OF THE RESULTS

The constant term, β_0, is without consistent significance and thus does not lend itself to interpretation.

The relative Dividend Payout Ratio

The coefficient of the relative dividend payout ratio, β'_1, is consistently negative, but is significant at the 5 percent level in only one third of the regressions in the relatively low inflation year 1965. While in the high inflation year 1972 it is consistently negative and significant at the 5 percent level.

These results indicate that an increase in the relative dividend payout ratio will cause a decrease in the price per share of a firm's common stock, ceteris paribus. Thus investors act as if they believe that when a firm retains a lower percentage of its earnings relative to the previous year's retention rate that the

price per share of its common stock will decrease relative to the previous year's share price, because the future earnings potential has been reduced by the relatively lower retention rate.

A second interpretation which is consistent with these results is that for a given total return on a share of common stock, dividends plus price appreciation, if a firm increases its dividend relative to the previous year's dividend then the price per share does not have to increase relative to the previous year's share price in order to maintain the given total return.

It should be noted from Table 1, that in the 1965 regressions where the coefficient is statistically significant the value of the coefficient is approximately one-half the value of the 1972 coefficient. This indicates that in a period of relatively high inflation, ceteris paribus, a unit change in the earnings retention rate will cause almost twice the change in relative prices as compared to a unit change during periods of relatively low inflation. Further, if a firm wants to increase the relative price per share it should increase its retention rate, i.e. reduce its current dividend payout ratio, and this is even more important in a period of relatively high inflation. That firms may have employed this strategy appears to be borne out by the fact that the mean value of the 1972 relative dividend D_1/D_0 is only 91.5 percent of the mean value of the 1965 relative dividend ratio.

The Relative Historical-Dollar Accounting Earnings

The coefficient of relative historical-dollar earnings, β_2, is consistently positive and statistically significant in both years indicating that investors appear to like a relative increase in earnings per share. It should be noted from Table 1 that in the period of relatively high inflation, 1972, the values of the coefficient are approximately one-half those found in the period of a relatively low inflation, 1965. Thus in a period of relatively high inflation, ceteris paribus, investors appear to discount relative increases in historical-dollar earnings by approximately 50 percent, as compared to relative earnings in a period of low inflation. This may be an indication that investors may perceive a "quality of earnings" problem in relative historical-dollar accounting earnings in a period of relatively high inflation.

The Difference Between Historical-Dollar and General-Price Level Adjusted Depreciation

The coefficients of the Lagrangian polynomial proxies for the difference between historical-dollar accounting and general price-level adjusted depreciation, γ_{-i}, which are generated by linear combinations of β_3 and β_4, are significant at the 5 percent level in the 1965 regression, and not significant in the 1972 regression. In evaluating the individual values of the lagged coefficients developed by means of the Lagrangian polynomial it was found that the proxies for the most recent four years were all positive and significant at the 5 percent level in the 1965 regressions. In the 1972 regression, the coefficients of the proxies for the most recent three years were positive and significant at the 5 percent level, and in addition the coefficient of the most distant lagged proxy was negative and significant. All other coefficients were not significant at the 5 percent level in either year.

These results are at variance with those predicted in the full model, except for the most distant lagged year of the 1972 regressions. This anomaly may be caused by our inability to specify the replacement variable B_h, the percentage of this period's capital spending that is replaced h periods later. Thus, the chosen proxy represents general price-level adjusted capital spending with no provision for the replacement or the retirement of fixed assets. In this more restricted context the signs of the significant coefficients of the lagged proxies have economic meaning. In a period of relatively low inflation, 1965, investors looked favorably upon capital spending during the most recent four years. While in a period of relatively higher rate of inflation, 1972, investors only looked with favor on the most recent three year's capital spending, while capital spending in the 10^{th} previous year was looked upon as being deleterious to stock prices.

<u>The Inventory Holding Gain</u>

The coefficient of the inventory holding gain proxy, β_5, is consistently significant at the 5 percent level for both 1965 and 1972.

We therefore would like to investigate the following hypotheses:

Hypothesis I: In periods of continuing inflationary expectations the sign of the coefficient should be significant and negative, and in periods when there are no expectations of continuing inflation the sign should not be significant or negative.

Hypothesis II: In periods when there are no expectations of continuing inflation and firms experience inventory holding gains the coefficient should be significant and positive.

In 1965 the sign of the coefficient is consistently positive indicating that, in that year of relatively low inflation, investors looked favorably upon such gains. Using mean values of the 1965 data series, the average proxied holding gain represented only 5.9 percent of the increase in earnings for that year. Also, 1965 was the final year in a seven year period of relative price stability, when the inflation rate averaged less that 1.3 percent per year so that firms could look forward to replacing inventories at approximately the same cost. Thus investors might well perceive such holding gains as enhancing the relative price per share of a firm's common stock in a period of price stability.

In 1972 the sign of the coefficient is consistently negative, indicating that, in that year of relatively high inflation, investors looked with disfavor upon such gains. Using mean values of the 1972 data series, the average holding gain proxy represented 19.2 percent of the increase in earnings for the year. 1972 was the final year in a seven year period of relatively high inflation when the average annual rate of inflation exceeded 4.1 percent. Investors recognizing that inventory holding gains represented almost one-fifth of the increase in earnings for the year, and if their expectations were for an increasing rate of inflation this could mean inventory replacement at substantially higher costs leading to uncertainty about future earnings.

The coefficients for 1965 and 1972 regressions are consistent with hypothesis I, and the coefficient for the 1965 regression is consistent with hypothesis II.

The uncertainty about the true worth of inventory holding gains in a period of relatively high inflation may cause investors to perceive such gains as having a deletarious effect upon the relative price per share.

The Net-Monetary Debtor Leverage

The coefficient of the net-monetary debtor leverage proxy, β_6, was negative in both years and significant at the 5 percent level only in 1972. The coefficient's lack of significance in 1965 indicates that investors tended to ignore a firm's net-monetary debtor leverage position in valuing its common stock. That investors appear to have ignored a firm's net-monetary debtor leverage position may be attributable to two facts: in 1965 the mean value of the net-monetary debtor position proxy per dollar of earnings was only $1.31 and the mean value of the embedded cost of net-monetary debt was only 3.98 percent that year, for a mean total cost of servicing net-monetary debt of $.058 per dollar of current earnings.

In a period of relatively high inflation, such as 1972, the model and previous studies indicate that a net-monetary debtor leverage position should enhance the value of a firm's common stock. However, the results of these regressions indicate that investors appear to discount the value of a highly leveraged firm's common stock even in a period of relatively high inflation. This apparant anomaly may be explained by two facts: in 1972 the mean net-monetary debtor position per dollar of earnings was over three times that of 1965 at $4.20 and the mean embedded cost of net-monetary debt had increased fifty-five percent to 6.15 percent for a mean total cost of servicing net-monetary debt of $.259 per dollar of current earnings. The fact that the degree of net-monetary debt leveraging had increased over three times while the embedded cost of net-monetary debt had increased by one-half resulting in over a four-fold increase in the cost of servicing net-monetary debt may have overcome the beneficial effects of a net-monetary debtor position in a period of relatively high inflation.

The Expected Dividend Growth Rates

The coefficients of the expected dividend growth rate proxies, β'_9 and β'_{10} are of mixed signs and lack consistent statistical significance in both 1965 and 1972. The joint addition of these two variables likewise does not contribute significantly to the regression.

The Relative Risk Premium

The coefficients of the relative risk premium proxies, β'_{11} and β'_{12} are individually of the predicted sign in both 1965 and 1972, but only the 1965 coefficients for the previous year's relative risk premium are significant at the 5 percent level. However, the joint addition of the relative risk premium proxies are significant at the

5 percent level in both 1965 and in 1972. These results indicate that proxies based upon the Value Line Investment Survey risk-rankings when incorporated in the valuation model developed in this research perform as predicted. The average value of the risk premium proxies in 1965 were close to the risk premium for the market as a whole, which is 3.0. The mean value for the previous year's risk premium proxy was 2.65 decreasing slightly to 2.74 for the current year's risk premium proxy in 1965. In 1972 the mean values of the previous year and the current year risk premium proxies are identical at 2.24 indicating a further decrease in the risk level for the firms studied in this research.

This decrease in risk may be attributable to Value Line's more generous use of the higher "safety" classifications in 1972 as compared to its 1965 rankings, or to an inaccurate perception of risk in a period of relatively high inflation.

SUMMARY OF FINDINGS

Investors appear to have learned that in an inflationary period a relatively high dividend payout ratio, or a relatively low earnings retention rate, reduces future earnings potential. This is reflected, of course, in relatively lower prices per share for a given level of dividends. This finding appears to be at variance with the works of Professors Gordon and Arditti.[51] However, it should be pointed out that their empirical studies covered periods of relative price stability and were based upon historical-dollar accounting data.

Investors have detected the inventory profit illusion. Thus FIFO-caused inventory holding gains in a period of relatively high inflation do not help the relative price per share.

Investors appear to discount an increase in relative historical-dollar accounting earnings in a period of high inflation by approximately 50 percent as compared to the same increase in relative historical-dollar accounting earnings in a period of low inflation. Thus investors appear to perceive a "quality of earnings" problem in

51 Myron J. Gordon, "Dividends, Earnings and Stock Prices," The Review of Economics and Statistics, vol. 41, no. 2, (May, 1959), pp. 99-105.

Fred D. Arditti, "Risk and the Required Rate of Return on Equity," The Journal of Finance, vol. 22, (March, 1967), pp. 19-36.

relative historical-dollar accounting earnings during an inflationary period.

Investors were not sensitive to a firm's net-monetary debtor leverage position in a period of price stability. This finding is in accord with previous studies. Also, previous studies indicate that a net-monetary debtor position should enhance relative common stock prices in a period of relatively high inflation. The results of this study indicate just the opposite effect - that investors look with disfavor upon a net-monetary debtor position. These results may be due to investor fears that the debt burden is excessive in view of the higher costs of servicing that debt and the increased uncertainties about the "quality" and variability of future earnings. By incorporating the cost of servicing a net-monetary debtor position in this study we have included not only the benefits, but also the costs attributable to such a position. Thus these results may not be at variance with previous studies, but represent an extension of Professors Alchian, Kessel and others.

Investors appear to be indifferent to the under-depreciation of fixed assets caused by the use of historical-dollar accounting in comparison to general price-level adjusted accounting. This may be attributable to our inability to specify the replacement variable in the model, or it may indicate that investors are insensitive to the more distant lagged capital spending in periods of relatively high inflation.

The study failed to get a clear reading on both expected dividend growth rates and the effect of risk upon stock valuation.

APPENDIX

APPENDIX

DEFINITION OF VARIABLES

A. Source: VALUE LINE INVESTMENT SURVEY, "Summary of Advices and Index".

P_1: The average of weekly closing prices for December of the current year.

$w_1'^m - w_1'$: The relative risk of the firm to that of the market as a whole as perceived in the second week of the December prior to the current year. Risk was proxied using VALUE LINE'S five risk class estimates. The firm was assigned a rating of 1 - 5, with risk classification 1 representing the least risky classification. The market as a whole was assigned the median risk classification 3.

$w_o^m - w_o$: The relative risk of the firm to that of the market as a whole as perceived in the second week of the December prior to the previous year. Risk was proxied using VALUE LINE'S five risk class estimates. The firm was assigned a rating of 1 - 5, with risk classification 1 representing the least risky classification. The market as a whole was assigned the median risk classification 3.

B. Source: Standard and Poor's Annual Primary Industrial File, COMPUSTAT tape. (Data Item shall be referred to as DI)

E_0: The historical-dollar accounting earnings in the previous year.

E_0 = Available for Common (DI 20)

D_1: The common stock dividend per share (DI 26)

b_1: The dividend payout ratio for the current year.

$$b_1 = \frac{D_1}{\frac{\text{Available for common (DI 20)}}{\text{Common shares outstanding (DI 25)}}}$$

$\bar{m}_p$: The embedded money rate of interest.

$$\bar{m}_p = \frac{\text{Fixed charges (DI 15)} + \text{Preferred dividends (DI 19)}}{\text{Long term debt (DI 9)} + \text{Debt in current liabilities (DI 34)} + \text{Preferred at redemption value (DI 56)}}$$

CS_i: The capital expenditures (DI 30)

DR_1: The depreciation rate in the current period.

$$DR_1 = \frac{\text{Depreciation and amortization (DI 14)}}{\text{Gross plant and equipment (DI 7)}}$$

V_1: A dummy variable such that $V_1 = 0$ if LIFO

$V_1 = 1$ if FIFO

V_1 = Inventory valuation method (DI 59)

T_1: Inventory turnover rate.

$$T_1 = \frac{\text{Cost of goods sold (DI 41)}}{\text{Inventories (DI 3)}}$$

IN_0: Inventories (DI 3)

M_0: The net-monetary debtor position for the previous period.

$$M_0 = \text{Current liabilities (DI 5)}$$
$$+ \text{ Long term debt (DI 9)}$$
$$+ \text{ Preferred stock at redemption value (DI 50)}$$
$$- \text{ (Current assets (DI 4)}$$
$$- \text{ Inventories (DI 3))}$$

g_1': The expected dividend growth rate as perceived during the current year

$$g_1' = e^{0.3\left[\frac{1}{3}\sum_{t=-1}^{-5} t \ln D_t - \sum_{t=-1}^{-5} \ln D_t\right]}$$

D_t = Dividends per share (DI 26)

I_1: The C.P.I. value for the current period.

I_0: The C.P.I. value for the previous period.

K_1: The inflation rate for the current period.

$$K_1 = \frac{I_1 - I_0}{I_0}$$

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