ABSTRACT

Relationship Between Stock Prices,

And Accounting Earnings

This paper examines the use of logarithmic linear transformations of nonlinear relationships found in financial accounting empirical research. The relationships examined include the relationship between earnings, dividend declarations and investor returns. This research demonstrates that accounting earnings and investor returns display a stronger relationship than has been previously shown and the information contained in accounting earnings are useful to financial markets. Aharony and Swary (1980) found the dividends contain information similar to, but different from, the information contained in accounting earnings. The empirical results reported here, that most of the information contained in dividends, that is useful to financial markets, is also contained in accounting earnings. There does appear to be some useful information in dividends that is not contained in accounting earnings. The results are consistent with this incremental useful information resulting from management's signaling of expected future earnings through dividend declarations.

RELATIONSHIP BETWEEN STOCK PRICES AND ACCOUNTING EARNINGS

Introduction:

This paper examines the use of logarithmic linear transformations of nonlinear relationships found in financial accounting empirical research. The model proposed in this research provides explanatory power beyond that demonstrated in prior research models. The increased explanatory power offers the potential to further knowledge surrounding the area of financial accounting as Easton et al. (1992, p. 122).

> Empirical research designs should be motivated by questions asked, and not by the magnitude of correlation measures. However, we note that 'high R^2 settings' often make it easier to conceptualize and test for the effects of variables potentially relevant in explaining the dependent variable. This point, combined with the behavior of the R^2 . . . might be useful in some contexts of market-based accounting research; research designs . . . may have a better chance of providing useful evidence for many empirical issues.

The relationships examined in this paper include the relationship between the earnings figures computed by accountants ("accounting earnings" or "earnings"), and the returns earned by investors ("investor returns"). These relationships are important because within the empirical accounting arena, the usefulness of information in financial markets is measured by its relationship with investor returns (Ball and Brown, 1968; Watts and Zimmerman, 1986).

The empirical results presented here are consistent with the notion that accounting earnings provide information used by financial markets in valuing firms. Moreover, these results are consistent with the premise that a firm's management signals information regarding its expectations of the future accounting earnings of the firm, and that financial markets use these signals. This research contributes to the literature that examines the use of accounting earnings by financial markets, and thereby, underscores the importance of accounting earnings to the workings of financial markets. This advancement of knowledge is important because it touches upon the relevance of the accounting profession. The Financial Accounting Standards Board (FASB) utilizes a great deal of time and effort in setting accounting standards. The issuance of each Statement of Financial Accounting Standards is accompanied by lobbying by parties whose interests could be affected by the changes in financial standards.[1] Despite prospective controversies, FASB continues to refine financial standards in order to, among other things, provide information that is useful to present and potential investors and creditors and other users in making rational investment, credit and similar decisions. Much of FASB's efforts are concentrated on the standards used to determine earnings. In theory, these standards should culminate in a "bottom-line" earnings figure that summarizes the performance of each firm over a given accounting period. This research examines whether the users of financial information find these "bottom-line" earnings figures "useful", as intended by FASB.

Equity Valuation Based upon Earnings:

Despite ubiquitous reports within the financial press of market reactions to firm earnings announcements, some academics have hypothesized that the usefulness or the quality of the information contained in the "bottom-line" accounting earnings figure is weak.[2] These academics argue that the latitude given to accountants and management in selecting between competing conventions in reporting earnings (*e.g.,* depreciation methods), as well as the inappropriateness of some accounting conventions, introduces such variances and inaccuracies into reported earnings that the usefulness of accounting earnings to financial markets and others is reduced considerably from what it would be without this flexibility. These beliefs are reinforced by empirical studies that show stock price reactions to unexpected changes in accounting earnings are insignificant, with adjusted R^2 s commonly in the range of only 2% - 15% (Lev, 1989). Indeed, Lev (1989, p. 155) concludes that:

> The correlation between earnings and stock returns is very low, sometimes negligible. (and that) These findings suggest that the usefulness of quarterly and annual earnings to investors is very limited.

Other academics have suggested that the poor empirical results are caused by the failure of researchers to specify the appropriate model necessary to capture the relationship between stock price movements and unexpected earnings.[3]

In order to test this contention regarding model misspecification, this study develops an alternative model designed to more efficiently detect any empirical regularities between accounting earnings and stock prices. As hoped, the model here demonstrates a substantially stronger relationship between stock price movements and unexpected earnings than has been previously shown. The strength of this relationship supports the concept that financial markets find the information contained in reported earnings useful in setting prices.

The model developed herein, however, also supports the first hypothesis regarding a reduction in usefulness due to flexibility in determining earnings. The structure of the model suggests that the response of investor returns to unexpected earnings is not uniform. This model assumes that the relationship between investor returns and earnings is nonlinear with a decreasing response by investor returns to increasing unexpected earnings. Moreover, it also assumes a multiplicative error term with a lognormal distribution. Thus, the model assumes that the differences between the actual investor returns and the investor returns predicted by the model will increase with increasing unexpected earnings.

The model tested in this paper represents a refinement of ones used in prior research studies. In particular, the model tested is based on one discussed in Ohlson (1991) and tested in Easton and Harris (1991). The Ohlson (1991) model suggested that prices reflect a capitalization of earnings at a constant rate. Unlike the Ohlson (1991) model, however, the model tested here displays different annual capitalization rates. Moreover, the model tested by Easton and Harris (1991) was linear with an additive error term that is normally distributed. Alternatively, the model developed in this paper assumes a relationship that is nonlinear with an error term that is multiplicative with a lognormal distribution. The data screens used in this paper also differ from those used in Easton and Harris (1991). The screens employed in this analysis attempt to reduce the influence of situations in which prices do not reflect a capitalization of earnings.

If (i) an appropriate regression model is employed, and (ii) the sample tested is properly screened, then the adjusted R^2 produced by such a regression improves dramatically over the adjusted R^2 s generated by previous models. The use of dummy variables in the model raises the adjusted R^2 to approximately 43%, and the screens used in this model raise the adjusted R^2 to approximately 55%. For example, when these techniques are used with the model proposed in Ohlson (1991), the adjusted R^2 rises to approximately 44%.

The Model Definitions

The model developed in this section has strong similarities to, but important differences from, the one discussed in Ohlson (1991), and empirically tested in Easton and Harris (1991). Consistent with the Ohlson (1991) model, the following terms are used here:

P_{it}	the price of one share of common stock of firm i at the end of year t;
d_{it}	the dividends declared by firm i in year t, per share of common stock;
e_{it}	the reported earnings per share before extraordinary items of firm i for year t;
$E(e_{it+1} \mid e_{it})$	the expected earnings per share before extraordinary items of firm i for year t + 1 determined at end of year t, as anticipated by financial markets;
K_{it}	the coefficient, which is multiplied by e_{it} to obtain the sum of P_{it} and d_{it}; and
C_{it}	the coefficient, which is multiplied by $E(e_{it+1} \mid e_{it})$ to obtain P_{it}.

The Ohlson (1991) Model

As noted in Ohlson (1991), the sum of the price of a firm's common stock at the end of a year and the dividends declared by that firm during that year can be represented as the capitalization of the earnings of that firm for that year:

$$P_{it+1} + d_{it+1} = K_{it+1} \; e_{it+1} \quad (1)$$

[4]

Dividing equation (1) by P_{it}, results in the following equation:

$$(P_{it+1} + d_{it+1}) / P_{it} = K_{it+1} (e_{it+1} / P_{it}) \quad (2)$$

Specification of the Error Terms

The Ohlson (1991) model does not specify the error terms to be used.[5] Eq. (2) could be modeled using an additive error term with a normal distribution:

$$(P_{it+1} + d_{it+1}) / P_{it} = (K_{it+1} (e_{it+1} / P_{it})) + \epsilon_{it+1}{}^{6} \qquad (3)$$

The relationship could also be modeled using a multiplicative error term with a lognormal distribution:

$$(P_{it+1} + d_{it+1}) / P_{it} = (K_{it+1} (e_{it+1} / P_{it})) \exp(\epsilon_{it+1})^{7} \qquad (4)$$

The issue of which error to specify is discussed in Judge, *et.al.* (1980, pg., 844-45). Judge et al. suggest that a test outlined in Leech (1976) may be used to determine whether a version of the basic model using an additive nonexponential error term or a multiplicative exponential error term is more appropriate for a given data set. The Leech test provides that the version of the basic model producing the higher value for the log likelihood function is the more appropriate version of that model.

Versions of equations (3) and (4) were tested using the Leech test, and, as noted in Table 1, the multiplicative error term produced the larger log likelihood value. By way of comparison, when versions of equations (3) and (4) were tested using OLS regressions, the additive error models consistently produced lower adjusted R^2 than those produced by the multiplicative error models.

Further Refinements to the Multiplicative Error Model

Multiplying the right-hand side of equation (4) by (e_{it}/ e_{it}) results in the following equation:

$$(P_{it-1}+d_{it+1})/P_{it} = (K_{it+1} (e_{it+1}/e_{it})/P_{it}/e_{it})) \exp(\epsilon_{it+1}) \qquad (5)$$

Taking the natural logarithm of all the variables produced the following linear equation:

$$\ln((P_{it-1}+d_{it+1})/P_{it}) = \ln(K_{it+1}) + \ln(e_{it+1}/e_{it}) - \ln(P_{it}/e_{it}) + \epsilon_{it+1} \quad (6)$$

Equation (2.6) establishes the basis of the regression model used in this research. Because the earnings capitalization rates differ each year, annual dummy variables are added. These dummy variables together with the intercept approximate the natural logarithm of K_{it+1}.:

$$\ln((P_{it-1}+d_{it+1})/P_{it}) =$$

$$a + b \ln(e_{it+1}/e_{it}) + c \ln(P_{it}/e_{it}) + z_1 Y_{74} + z_2 Y_{75} + \ldots + z_{19} Y_{92} + \epsilon_{it+1} \quad (7)$$

Relationship to Previous Research (Unexpected Earnings)

As noted in Ohlson (1991), the right hand side of equation (2), upon which equation (7) is based, represents unexpected earnings. [8]Ohlson notes that prices reflect expected future earnings:[9]

$$P_{it} = C_{it} E(e_{it+1} \mid e_{it}) \quad (8)$$

Substituting equation (8) into equation (2) , results in the following:

$$(P_{it+1} + d_{it+1}) / P_{it} = (K_{it+1}\, e_{it+1}) / (C_{it} E(e_{it+1} \mid e_{it})) \quad (9)$$

Equation (9) is similar to traditional studies in which investor returns are regressed upon forecast errors. The following equation is typical of these models:[10]

$$\frac{(P_{it+1} + d_{it+1}) - P\,it}{P_{it}} = \frac{e_{it+1} - E(e_{it+1} \mid e_{it})}{E(e_{it+1} \mid e_{it})} \quad (10)$$

The left hand side of equation (9) is one plus the left hand side of equation (10). The major element of the right hand side of equation (10) is the forecast error ((e_{it+1} – $E(e_{it+1} \mid e_{it})$) /$E(e_{it+1} \mid e_{it})$), which is the equivalent of the right hand side of equation (9) (except for (C_{it}), which is surplusage),[11] reduced by one. Thus, the major elements of equation (7) are similar to traditional investor returns unexpected earnings studies, except that equation (7) employs a nonlinear model with multiplicative error terms, which are lognormally distributed.

Use of P/E Ratios in Calculating Financial Market Expectations

As noted above, financial market expectations as to the future earnings of a firm are introduced through the use of beginning price (P_{it}), which is part of the beginning price/earnings (P/E) ratio variable. The relationship between P/E ratios and future earnings has been observed in prior studies. Beaver and Morse (1978) demonstrated that P/E ratios were related to future earnings changes. Similarly, Beaver, et al. , (1980); Beaver, et al., (1987); and Collins, et al., (1987) found that stock price changes lead accounting earnings changes. In addition, Ou and Penman (1989) noted that P/E ratios are better than price changes in indicating future earnings changes.

P/E ratios were used in regressions in Collins, et al., (1992). Collins, et al., showed that current investor returns are related to (i) the beginning P/E ratio, as well as (ii) current earnings changes, (iii) the change in the book value of assets, (iv) the next three years' earnings changes, and (v) the stock price changes for the next three years. Similar to equation (7) Collins, et al., included beginning P/E ratios and changes in current earnings in their model. Equation (7) however, differs somewhat from the one developed by Collins, et al., in their use of other independent variables, and the use in equation (7) of natural logarithms and annual dummy variables.

Nonuniform Reaction to Good News and Bad News

As noted above, regression equations typically involve linear models with additive error terms that are normally distributed. In equation (3), the linear regression model assumes the following relationship between investor returns and unexpected earnings:

$$(P_{it+1} + d_{it+1}) / P_{it} = a + b\,(e_{it+1} / P_{it})) + \epsilon_{it+1} \qquad (11)$$

Equation (4), upon which equation (7) is based, assumes the following underlying relationship between unexpected earnings and investor returns:

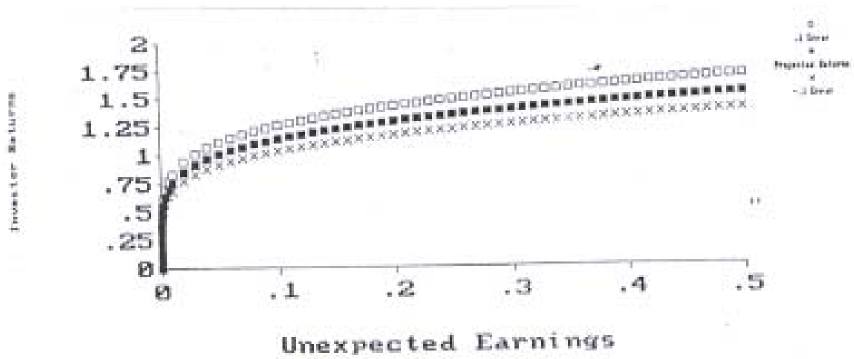
$$(P_{it+1} + d_{it+1}) / P_{it} = a\,(e_{it+1} / P_{it}))^{b} \exp(\epsilon_{it+1}) \qquad (12)$$

The characteristics of these different relationships are displayed in Figure 11. Figure 12 uses the mean coefficients produced from running annual regressions based upon equations (*) and (**) and assumes that the error terms take value of $\pm$ .1. The two underlying relationship equations project the following investor returns:

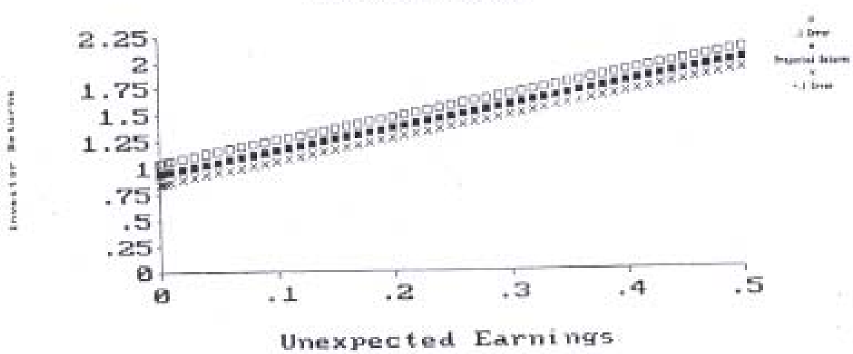
FIGURE 2.1

GRAPHS OF THE UNDERLYING RELATIONSHIPS

RESEARCH MODEL



OHLSON MODEL



With the Dissertation Model, the underlying relationship presented is:

(P it + 1 +d it + 1/Pit) = exp(.546446)* (e it + 1/Pit).181821 error term. The error term in the Dissertation model is assumed to be exp.(.1) and exp(-.1).

With the Ohlson Model, the underlying relationship presented presented is:

(P it + 1 +d it + 1/Pit) = .946545 + 2.109497(e it + 1/Pit) + error term.

The error term in the Ohlson model is assumed to be $\pm$.1.

The coefficients used in these equations are the mean values for the coefficients produced by the annual regressions, the results of which are reported in Section 2.5.2.

The implication of the traditional structure of the Ohlson model (equation (11) is that the reaction of investor returns to unexpected earnings is constant over the range of unexpected earnings.[12] On the other hand, assuming that the exponent b in equation (12) is less than one,[13] the nonlinear nature of the underlying relationship of the research model suggest that investor returns change more in response to bad news than they do to good news. Moreover, the multiplicative nature of the error terms of the underlying relationship suggests that the investor return reaction will be less systematic the greater the magnitude of unexpected earnings.

Argueably, when the earnings reported by a firm are substantially below expectations, financial markets treat the earnings as sufficient summary of the firm's operations. In this case, stock price movements are determined largely by the information contained in the reported earnings. On the other hand, when the earnings reported by a firm are substantially above expectations, financial markets probably examine other information (including information contained in the financial statements of firm), as well as earnings, in setting stock prices.

<u>Data and Methodology</u>

Sample Selection

The sample was selected from the *Compustat* Industrial Annual data set, which includes the Primary-Supplementary-Tertiary (PST) files. To be included within this sample in any one year, a firm must have a December 31 fiscal year end. This requirement ensures that the variables being studied are subject to the same interest and capitalization rates, because they are all compiled over the same twelve-month period.[14]

The imposition of this screen raises the adjusted R^2 by approximately 2%.[15] The firm must also have sufficient data in the *Compustat* data set in order to calculate the variables required by the different modes. All of the above requirements result in data set consisting of 21,016 annual observations. In order to be consistent with Easton and Harris (1991), all observations for which (e_{it+1}/P_{it}) were either lower than –1.5 or greater than 1.5 were omitted. This reduces the data set to 20,870 annual observations. Because equation (7) uses natural logarithms, the terms of the model must be positive. Thus, a firm is required to have positive earnings for the current and the prior year.[16] This requirement reduces the data set to 17,280 observations.

It should be noted that stock prices do not always reflect a capitalization of earnings. For example, a positive equity valuation in the case of a firm experiencing losses indicates that prices do not always reflect capitalized earnings. Similarly, it is hypothesized that the valuation of common stock for a firm that experiences positive income below a given level will be affected by other factors (*e.g.,* liquidation value or actual or potential tender offers). In these situations, because a firm's earnings do not influence the price of that firm's common stock for the year, then the change in the firm's stock price during the current year or the next year should not be influenced by the earnings for that year.[17] In an effort to remove (or at least reduce) the influence of these situations, observations that result in the highest 25% beginning or ending P/E ratios in any given year are disregarded along with loss year observations. The screening for a portion of the highest P/E ratios is also necessitated because of the nature of ratios in general. When computing ratios, a small denominator is likely to produce an artificially high ratio.[18] This screen for "higher" beginning P/E ratios does not change the adjusted

R^2 , but the data set is reduced to 12,770. The screening for “higher” ending P/E ratios raises the adjusted R^2 by approximately 13%.

The number of firms per year that satisfy all of these requirements ranges from 490 to 697. The yearly observations of the firms that satisfy the above requirements are aggregated into one data file with 11,054 observations.

Prices Used in this Study

The year-end (December 31) price of a firm’s common stock is used consistent with previous studies such as Beaver and Morse (1978) and Basu (1983). Although Ball and Brown (1968) suggest that financial markets anticipate changes in earnings prior to the actual announcement of those earnings, it could be argued that the price of a firm’s common stock does not fully reflect its fourth quarter earnings as of its fiscal year end. An alternate approach would be to use the price existing after the announcement of the earnings for any year, or the price following an approximation of that date (*e.g.,* three months following the fiscal year end). Foster (1986, pg. 436) notes that prices on both dates are commonly used. The argument against using the alternate date relies on the Ball and Brown (1968) findings, and the fact that the use of the alternate date would allow events in the subsequent year to affect the P/E ratio. In this study, beginning P/E ratios help to establish financial market expectations as to earnings changes in the upcoming year, and it is therefore important to separate P/E ratios from events in the upcoming year. This concern necessitates the use of prices determined at the end of the fiscal year.[19]

EMPIRICAL RESULTS

Overall OLS Regression

An OLS regression of equation (7) produces an adjusted R^2 of .5497 and the coefficients and t-statistics displayed in Table 2. The t-statistics for the coefficients of all of the independent variables reported below are significant at the .0005 level.

The empirical results from testing equation (2.7) are fairly remarkable when compared to previous studies. The results are even more impressive considering that: (i) the earnings of all firms are capitalized at the same annual rate,[20] and (ii) no attempt is made to control for external confounding events (*e.g.,* tender offers, mergers or other news events), other than by screening for "higher" P/E ratios.

Annual Regressions

Because of the potential effect of cross-sectional correlation among the error terms on the t-statistics for studies with longer windows (as is the case here), the regression is run for each year separately, and the annual results are then used to calculate unbiased t-statistics for the regression coefficients.[21] The results appear in Table 3. The t-statistics for the coefficients of all of the independent variables are significant at the .0005 level.

The annual coefficients of the two independent variables are remarkable in that they are fairly constant over time. The standard deviation of the annual coefficients for the earnings variable $\ln (e_{it+1} / e_{it})$ is .065 and the standard deviation of the annual coefficients for the natural logarithm of the beginning P/E ration is .081.[22]

This is probably the result of the logarithmic relationship assumed in the regression model. The use of logarithms in the regression equation reduces the impact of larger variable values because the change in logarithms of a variable associated with a given change in that variable decreases as the magnitude of the variable grows. This property of logarithms reduces the need for the regression model to adjust its coefficients in order to accommodate outlier observations.[23] As noted in Section nonuniform reaction, the model anticipates the reaction of financial markets to larger magnitudes of unexpected earnings.[24]

Firm Size

Because the reaction of the value of a firm's common stock to earnings changes varies by the size of the total market value of the firm's common stock,[25] the observations for each year are ranked by aggregate market value (determined at the beginning of the year being examined) and partitioned into three groups: (i) large firms (highest 30% of beginning aggregate market value in any year); (ii) medium firms (middle 40% of beginning aggregate market value); and (iii) small firms (lowest 30% of beginning aggregate market value). This partitioning took place prior to the P/E screening described above. The annual regressions of equation (7) were then repeated for each of the market value groups, and the results are summarized in Table 2.4. The t-statistics for the coefficients of all of the independent variables are significant at the .0005 level.

As suggested by Table 4, unexpected earnings have the greatest explanatory power for the investor returns for smaller firms, and they have the least explanatory power for larger firms. Moreover, the magnitude of the coefficients of the independent variables are inversely related to firm size. It is arguable that financial markets have more information available to them regarding larger firms than is the case for smaller firms. [26] With the amount of alternative information available to financial markets proportional to the size of the firm, it is likely that the relative importance of the information contained in accounting earnings is inversely related to firm size.

Annual Dummy Variables

The use of annual dummy variables in equation (7) raises the question of what they represent. According to equations (6) and (7), the intercept and the annual dummy variables should represent the capitalization factor for the current year (K_{it+1}). Despite equations (6) and (7), nothing limits the factors represented by the annual dummy variables. Anything affecting investor returns which is not reflected in the two main independent variables, (e_{it+1}/e_{it}) and (P_{it}/e_{it}), may be reflected by the dummy variables.

For example, the annual dummy variables may reflect the change in the capitalization rates rather than the current year's capitalization rate. As noted before, if the regression equation were structured with the earnings change variable ($e_{it} + {}_{1}$) /e_{it}) as the sole independent variable, then the intercept and the dummy variables would represent one plus the change in the capitalization factors (K_{it+1}/C_{it}).[27]

The prior year's capitalization factor (C_{it}) also appears in equation (7), but only as part of the beginning P/E ratio. The regression may need the prior year's capitalization factor separately stated from the beginning P/E ratio, and may supply it through the annual dummy variables. After all, the earnings change variable (e_{it+1}/e_{it}) drives the relationship summarized in equation (7). As shown in Table 4, the earnings change variable is far more significant than the other independent variable (P_{it}/e_{it}). In addition, if the regression equation were structured with the earnings change variable as the sole independent variable, then such a regression would have approximately 80% (.4646) of the explanatory power of equation (7) using both the earnings change variable and the beginning P/E ratio.[28]

Alternatively, the annual dummy variables might approximate the annual market-wide movements in investor returns. Such movements should be related to the change in capitalization rates (which are hypothesized to be reflected in the annual dummy variables) because they are both influenced by the changes in interest rates or earnings. If so, the annual dummy variables should reflect such movement because it is not reflected in the other independent variables.

In order to test which factors the dummy variables represent, equation (7) was run without them, and using proxies for the variables considered above. The proxy used for the annual capitalization factor (K_{it+1}) is the median P/E ratio for the current year for the sample (determined prior to the screen for "higher" P/E ratios). The proxy used for one plus the change in the annual capitalization factors (K_{it+1}/C_{it}) is the median P.E ratio (determined prior to the screen for "higher" P.E ratios) for the current year (for the sample) divided by the median P/E ratio for the prior year. The proxy used for the market-wide movement in investor returns is the median investor return for the current year for the sample (determined prior to the screen for "higher" P/E ratios).

It is likely that the annual dummy variables are approximating a combination of all three alternate independent variables. The substitution of the proxy for one plus the change in annual capitalization factors comes closest to approximating the explanatory affect of equation (2.8) using annual dummy variables. The difference between the regression results using the dummy variables or this proxy can be explained, arguably, because of the regressions used proxies rather than the real variables. Similarly, the substitution of the median investor return for the current year produces an adjusted R^2 almost as high as one plus the median change in capitalization factors.

The fact that these two alternative variables are similar is evidenced by the fact that when both are included in the regression the adjusted R^2 only rises to .5201. This would lend support to the hypothesis that annual market-wide movement in investor returns is a function of changing capitalization rates and firm earnings announcements. In any event, it demonstrates that they are related.

Finally, while the adjusted R^2 produced by the proxy for the current year's capitalization factor (the median P/E ratio for the current year) produces a lower adjusted R^2, when it and the proxy for change in capitalization rates are both used as independent variables, the adjusted R^2 increases to .5363. Adding the median investor return as a third independent variable does not increase this adjusted $R^{2.}$

Summary and Conclusion

As noted before, Lev's criticism of the prior research in this area points to the low explanatory effect of the previous studies and the instability of the parameters over time. This analysis addresses both issues.

First, this study demonstrates a stronger relationship between unexpected earnings and investor returns than previous empirical research. While the strength of this relationship between unexpected earnings and investor returns suggests that a firm's reported earnings contains information that financial markets use in setting prices, the nonlinear nature of the underlying relationship assumed in the model used here suggests that the degree to which the earnings information is used by financial markets declines proportionately as the reported earnings exceed expectations.

Second, this analysis shows that the relationship is more constant over time than was the case with prior models. The standard deviation of the different annual coefficients for the principal independent variables are approximately 10% of the coefficients of similar variables in prior models.

One of the refinements employed in this analysis is the use of annual dummy variables. Adjusted R^2 s, similar to those produced when annual dummy variables are used, are produced when these dummy variables are replaced with proxies for either: (i) the annual change in capitalization factors, or (ii) the annual market-wide investor return. This behavior suggests that both variables are approximated by the annual dummy variables, and it also suggests that the two variables are related.

TABLE 1
LEECH (1975) TEST FOR APPROPRIATE ERROR TERM

Error Term	Log likelihood[1]
Additive Error Term with Normal Distribution:	-4479
Multiplicative Error Term with Lognormal Distribution:	-1943

[1]In the case of the additive error term with a normal distribution, the log likelihood is calculated as follows:

$$-(n/2)(1 + 1n(2\pi/n) – (n/2)(1n(\Sigma((Ret-1)-(a_1 +(b_1(e_{it+1}/P_{it}))-1))^2))$$

In the case of the multiplicative error term with a lognormal distribution, the log likelihood is calculated as follows:

$$-(n/2)(1 + 1n(2\pi/n) – (n/2)(1n(\Sigma((Ret)-(a_2-b_2\ 1n(e_{it+1}/P_{it}))-1))))^2))- 1n(\Sigma 1n(Ret))$$

Description of the variables: The terms a_1, a_2, b_1 & b_2 are the maximum likelihood estimators of the coefficients of the equation in question. They are the coefficients of the following regressions:

$$Ret = a_1+ b_1(e_{it+1}/P_{it}) + e_1 \text{ and}$$

$$1n(Ret) = 1n(a_2) + b_2ln(e_{it+1}/P_{it}) + \varepsilon_2$$

provided that e_1 and e_2 can be assumed to be normally distributed. The term Ret is the investor return (P_{it-1}+d_{it+1}/P_{it}). Pit is the price of one share of common stock of firm I at the end of year t. The term d_{it} represents the dividends declared by firm i on one share of its common stock during year t. The term e_{it} represents the earnings per share of firm I before extraordinary items. Σ is the sum of all the values of that variable for observations 1 through n.

TABLE 2

OLS REGRESSION OF EQUATION (7) USING OBSERVATIONS FOR ALL YEARS AND ANNUAL DUMMY VARIABLES

$\ln((P_{it-1}+d_{it+1})/P_{it}) = a_0 + a_1 (\ln(e_{it+1}/e_{it})) + a_2(\ln(P_{it}/e_{it}) + a_3Y_{74} + a_4Y_{75} + \ldots + a_{21}Y_{92} + \epsilon_{it+1}$

	a_0	a_1	a_2
Adj. R^2: .5497			
N = 11,054			
Coefficients:	.8255	.4650	¯.2723
t-statistics:	(50.877)	(77.027)	(-46.115)

!Significant to the .0005 level of significance. The value of the t-distribution for 00 degrees of freedom (one tail) is 3.291 at the .0005 level of significance. Description of regression variables: Pit is the price of one share of common stock of firm I at the end of the year t. The term dit represents the dividends declared by firm I on one share of its commons tock during year t. The term eit represents the earnings per share of firm i before extraordinary items. Annual dummy variables (Y74 through Y92) were included in the regression.

TABLE 3

SUMMARY OF ANNUAL OLS REGRESSIONS OF EQUATION (7)

$$\ln(P_{it+1} + d_{it+1}/P_{it}) = a_0 + a_1 (\ln(e_{it+1}/e_{it})) + a_2(\ln(P_{it}/e_{it})) + \epsilon_{it+1}$$

	a_0	a_1	a_2
Mean Adj. R2:.3979			
N = 490 to 697			
Mean Cofficients:	.6708!	.4701!	-2742!
t-statistics	(11.824)	(31.750)	(-14.826)

!Significant to the .0005 level. The value of the t-distribution for eighteen degrees of freedom (one tail) is 3.922 at the .0005 level significance. The mean of the yearly coefficients was estimated was estimated to test for the effect of cross-sectional correlations in the error terms. The t-statistics reported are not biased by such correlations.

Description of regression variable: Pit is the value of one share of the common stock of firm I at the end of year t. The term dit represents the dividends declared by firm i on one share of its common stock during year t. The term eit represents the earnings per share of firm i before extraordinary items.

TABLE 4

SUMMARY OF ANNUAL OLS REGRESSIONS OF EQUATION (7) PARTITIONED BY TOTAL MARKET VALUE OF FIRM

$Ln(P_{it+1} + d_{it+1} / P_{it}) = a_0 + a_1(\ln(e_{it+1}/e_{it})) + a_2(\ln(p_{it}/e_{it})) + \epsilon_{it+1}$

	a_0	a_1	a_2
Small Firms:			
N = 187 to 226			
Mean Adj. R_2: .4096			
Mean Coefficients:	.7158!	.4928!	-.2964!
t-statistics:	(12.556)	(24.589)	(-16.896)
Medium Firms:			
N = 223 to 322			
Mean Adj. R_2: . 3530			
Mean Coefficients:	.6418!	.4473!	-2584!
t-statistics:	(9.546)	(27.607)	(--11.140)
Large Firms:			
N = 62 to 165			
Mean Adj. R_2: .3047			
Mean Coefficients	.5638!	.4226!	-.2278!
t-statistics:	(8.023)	(15.418)	(-7.596)

! Significant to the .0005 level. The value of the t-distribution for eighteen degrees of freedom (one tail) is 3.922 at the .0005 level of significance.

The mean of the yearly coefficients was estimated to test for the effect of cross-sectional correlations in the error terms. The t-statistics reported are not biased by such correlations.

Description of regression variables: Pit is the value of one share of the common stock of firm I at the end of year t. The d it represents the dividends declared by firm i on one share of its common stock during year t. The term eit represents the earnings per share of firm i before extraordinary items.

TABLE 5

OLS REGRESSION OF VARIATIONS OF EQUATION (7) USING OBSERVATIONS FOR ALL YEARS AND ADDITIONAL INDEPENDENT VARIABLES

$\ln(P_{it+1} + d_{it+1}/P_{it}) = a_0 + a_1 (\ln(e_{it+1}/e_{it})) + a_2(\ln(P_{it}/e_{it})) + a_3\ln(W_{it}) + \epsilon_{it+1}$

	a_0	a_1	a_2	a_3
W_{it} = median $(P_{it+1}/e_{it+1})/(P_{it}/e_{it}))$				
Adj. R^2 .5162				
N = 11,054				
Coefficients:	.5169[!]	.4586[!]	-.2008[!]	.8775[!]
t-statistics:	(51.245)	(76.027)	(-41.207)	(75.049)
W_{it} = median (P_{it+1}/e_{it+1})				
Adj. $R^{2:}$ .4357				
N = 11,054				
Coefficients:	-.2901[!]	.4985[!]	-.4001[!]	.5573[!]
t-statistics:	(-15.223)	(75.310)	(-66.691)	(75.310)
Wit = median $(P_{it+1} + d_{it+1}/P_{it})$				
Adj. R^2: .5000				
N = 11,054				
Coefficients:	.3644[!]	.4151[!]	-.1666[!]	.9153[!]
t-statistics	(33.974)	(67.837)	(-33.175)	(71.362)

! Significant to the .005 level of significance. The value of the t-distribution for 00 degrees of freedom (one tail) is 3.291 at the .0005 level of significance.

Description of regression variables: Pit is the price of one share of common stock of firm i at the end of year t. The term dit represents the dividends declared by firm I on one share of its common stock during year t. The term eit represents the earnings per share of firm I before extraordinary items.

[1] *See* Horngren (1973).

[2] As noted here, academics measure the usefulness of the information contained in accounting earnings figures by the strength of the relationship between those earnings figures and the returns received by investors from investing in the firm's questions.

[3] *See, e.g.,* Freeman and Tse (1992).

[4] *See* Ohlson (1991, pg. 9).

[5] While the Ohlson (1991) model does not specify an error term, an additive nonexponential error term was tested in both Easton and Harris (1991) and Easton, Harris and Ohlson (1992).

[6] Versions of equation (2.3) appear in Ohlson (1991, pg. 9) and Easton and Harris (1991, pg. 23) (equation (8)). In Easton and Harris (1991), (e_{it+1} /P i_t) was used as one of two explanatory variables, with ((e_{it+1}-e) / P_{it}) serving as the other independent variable. The two variables were viewed as complementary in Easton and Harris (1991); however, Easton, Harris and Ohlson (1991, pg. 138), the two variables were viewed as competing with (e_{it+1} /P_{it}) viewed as superior.

[7] Apart from the fact that the error term in equation (2.4) is an exponent of e, while the term in equation (2.3) is not, the properties of the two error terms are identical (*e.g.,* the expected values of the error terms are zero and the error terms are uncorrelated). See Leech (1976, pgs. 719-20).

[8] Ohlson (1991, pg. 12) notes that the use of (e_{it} /P_{it}) as in independent variable in a regression captures expectations: " . . .the deflation of P_{it+1} + d_{it+1} introduces an expectation concept of earnings on the equations RHS" Ball (1978), on the other hand, would argue that it introduces risk into the equation. See Section 2.2.6.3.

[9] Ohlson (1991, pg. 11).

[10] The deflator used varies. *See, e.g.,* Christie (1987)(beginning market value suggested as an appropriate deflator) and Beaver, Clarke & Wright (1979)(both expected earnings at the beginning of the year and standard deviation of forecast errors as deflators).

[11] *See* Ohlson (1991, pg. 12), which had the risk free as surplusage, and Section 2.4.4.

[12] *See,* e.g., Beaver and Landsman (1981).

[13] This is consistent with the empirical results reported in Section 2.5.2.

[14] Lev (1989, pg 168-69) notes that changes in discount rates could be a reason for the different annual relatinship between earnings and returns.

[15] *see* Table 2.7 in Section 2.5.1.

[16] This is a common practice in studies involving P/E ratios. *See, e.g.,* Jaffe, Keim and Westerfield (1989), Basu (1983, 1977).

[17] As noted in Section 2.2.5.1, this analysis assumes that investor returns are based solely on correcting for mistaken expectations as to current earnings held at the beginning of a year once the actual earnings for that year are observed. Clearly, the ending price component of investor returns are also affected by anticipated future earnings beyond the current year. *See* equation (2.8). The portion of this screen dealing with and ending P/E ratios helps to reduce the influence of observations in which a large increase in future earnings is reflected the ending price of a firm's common stock. The investor return in these observations should not be influenced by the change in earnings because current earnings did not determine the ending price of the firm's common stock, therefore, these observations will only serve as noise, if considered.

[18] This is similar to the "small denominator" problem discussed in Beaver, Clarke and Wright (1979). For example, if a firm the size of Paramount were to experience a loss in a year, then that observation would be deleted. If instead, the firm the $1 of net income before extraordinary items, its P/E ratio could be 6 billion.

[19] *See* Lev (1989, pg.169), and Section 2.4.4. There is no need for dummy variables in the annual regressions.

[20] However, it should be noted that the beginning P/E ratio may introduce the individual firm's capitalization factor into the cross-sectional regression.

[21] The t-statistics were calculated by multiplying the mean of the annual coefficients by the square root of the number of the annual coefficients. This product was then divided by the standard deviation of the annual coefficients. This method was described and endorsed in Fama and MacBeth (1973), Beaver, Clarke and Wright (1979) and Bernard (1987).

[22] *See* Section 2.5.2. Lev notes that the instability of the parameters is a major problem with prior studies. *See* Lev (1989, pg. 155).

[23] *See* Figure 2.1 in Section 2.2.5.2.

[24] See, e.g., Section 2.2.5.2. in which annual regressions were run using either (e it + 1 /P it) or ln($e_{it + 1} /P_{it}$) or ln ($e_{it + 1} /P_{it}$) as the independent variable. The standard deviation of the annual coefficients for ln ($e_{it + 1} /e_{it}$) is .059 and the standard deviation of the annual coefficients for ($e_{it + 1} /e_{it}$) is .618

[25] *See, e.g.,* Fama and French (1992) and Bernard and Thomas (1989). Fama and French suggest that firm size also reflects risk.

[26] *See, e.g.,* Busby (1975) and Verrechia (1980).

[27] See Section 2.5.5

[28] See Section 2.5.5

REFERENCES

Aharony, J. and I. Swary. "Quarterly Dividend and Earnings Announcements and Stockholder's Returns: An Empirical Analysis." *The Journal of Finance* (March 1980) 1-12.

Ball, R. and P. Brown, "An Empirical Evaluation of Accounting Income and Number." *Journal of Accounting Research* (Autumn 1968) 159-78.

Ball, R. "Anomalies in relationships Between Security Yields and yield-Surrogates." *Journal of Financial Economics* (1978) 103-26.

Basu, S., "Investment performance in common stocks in relation to their price-earnings ratios; at test of efficient market hypothesis." *Journal of Finance* (June 1997) 663-82.

Basu, S., "The Relationship Between Earnings Yield, Market Value and Return for NYSE Common Stocks." *Journal of Financial Economics* (1983) 129-57.

Beaver, W. and D. Morse, "What Determines Price-Earnings Ratios?" *Financial Analysts Journal* (July/August 1978) 65-76.

Beaver, W., R. Clarke, and W. Wright, "The Association Between Unsystematic Security Returns and the Magnitude of Earnings Forecast Errors." *Journal of Accounting Research* (Autumn 1979) 316-40.

Beaver, W., R. Lambert and D. Morse, "The Information Content of Security Prices." *Journal of Accounting and Economics* (March 1980) 3-28.

Beaver, W., W. Landsman, "Note on the Behavior of Residual Security Returns for Winner and Loser Portfolios." *Journal of Accounting and Economics* (December 1981) 233-241.

Beaver, W., R. Lambert and S. Ryan, "The Information Content of Security Prices: A Second Look." *Journal of Accounting and Economics* (July 1987) 139-57.

Bernard, V., "Cross-Sectional Dependence and Problems in Inference in Market-Based Accounting Research." J*ournal of Accounting Research* (Spring 1987) 1-48.

Bernard, V. and J. Thomas, "Post-Earnings-Announcement Drift: Delayed Price Response or Risk Premium?" J*ournal of Accounting Research* (Supplement 1989) 1-36.

Busby, S., "Company Size Listed Versus Unlisted Stocks, and the Extent of Financial Disclosure." *Journal of Accounting Research* (Spring 1975) 16-17.

Christie, A., “On Cross-Sectional Analysis in accounting Research.” *Journal of Accounting and Economics* (December 1987) 231-58.

Collins, D., S. Kothari and J. Rayburn, “Firm Size and the Information Content of Prices with Respect to Earnings.” *Journal of Accounting and Economics* (July 1987) 111-38.

Collins, D., S. Kothari, J. Shanken and R. Sloan, “Lack of Timeliness versus Noise as Explanations for the Low Contemporaneous Return-Earnings Association.” Working paper, University Rochester (1992).

Easton, P. and T. Harris, “Earnings as an Explanatory Variable for Returns.” *Journal of Accounting Research* (Spring 1991) 19-36.

Easton, P., T. Harris and J. Ohlson, “Aggregate Accounting Earnings Can Explain Most of Security Returns.” *Journal of Accounting and Economics,* (June/September 1992) 119-142.

Fama, E. and J. MacBeth, “Risk, Return & Equilibrium: Empirical Tests.” *Journal of Political Economy* (1973) 607-36.

Fama, E. and K. French, “The Cross-Section of Expected Stock Returns.” *Journal of Finance* (June 1992) 427-65.

Foster, G., *Financial Statement Analysis.* Englewood Cliffs, New Jersey: Prentice-Hall, 1986.

Freeman, R., “The Association Between Accounting Earnings and Security Returns for Large and Small Firms.” *Journal of Accounting and Economics* (July 1987) 195-228.

Horngren, C., “The Marketing of Accounting Standards.” *Journal of Accountancy* (October 1973).

Jaffe, J., D. Keim and Westerfield, “Earnings, Yields, Market Values and Stock Returns.” *Journal of Finance* (March 1989) 135-48.

Leech, D., “Testing the Error Specificantion in Nonlinear Regressions.” *Econometrica* (July 1975) 719-25.

Lev., B., “On the Usefulness of Earnings and Earnings Research: Lessons and Directions from Two Decades of Empirical Research.” *Journal of Accounting Research,* (Supplement 1989) 153-201.

Ohlson, J., “The Theory and Value of Earnings and an Introduction to the Ball-Brown Analysis.” *Contemporary Accounting Research*, (1991) 1-19.

Ou, J. and S. Penman, "Accounting Measurement, Price-Earnings Ratio, and the Information Content of Security Prices." *Journal of Accounting Research* (Supplement 1989) 111-44.

Verrechia, R., "The Rapidity of Price, Adjustments to Information." *Journal of Accounting and Economics* (March 1980) 63-92.

Watts, R. and J. Zimmerman, *Positive Accounting Theory.* Englewood Cliffs, New Jersey: Prentice-Hall, 1986.