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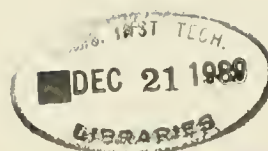






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FUNDAMENTAL FACTORS INFLUENCING PRICE EARNINGS  
RELATIONSHIPS: A CROSS SECTIONAL STUDY

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WP 1719-85

October 1985

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ABSTRACT

This paper investigates the firm specific characteristics that influence the relationship between security prices and accounting earnings. This relationship is measured by the magnitude of the slope and the correlation coefficient of price earnings regressions. The results indicate that factors such as research and development expense, pension expense, extraordinary items, intangibles, capital intensity, size, growth, accounting methods, risk influence the price earnings relationship. Further the dividend earnings relationship for the firm and the industry to which it belongs also strongly affect the price earnings relationship.



FUNDAMENTAL FACTORS INFLUENCING PRICE EARNINGS RELATIONSHIPS  
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1. Introduction

The relationship between security prices and earnings forms the methodological basis for a large number of accounting studies. The major studies of this relationship are those by Ball and Brown [1968] and by Beaver et al.[1979]. The former demonstrates the association between the sign of earnings forecast errors and unsystematic security returns. The latter extends this finding by showing that the magnitude of the unsystematic security returns is related to the magnitude of the earnings forecast error. This paper extends our knowledge of the price earnings relationship by investigating the firm specific characteristics which influence it.

The results of the paper, though a first step, will be useful to both investors, and regulators of accounting standards. By knowing the kinds of firms for which earnings are important determinants of prices and those for which they are not, investors can better apportion their time and effort in forecasting the earnings of different firms. As a major role of accounting information is to help investors in security valuation, this study will help regulators identify situations where accounting information is inadequate for valuation and thereby focus their attention on the areas where it is most needed.

In this paper we relate price changes and earnings changes longitudinally over time for 476 firms. We attempt to explain the magnitude and the significance of the slope coefficients of this relationship using a number of firm specific characteristics. We find that certain expense categories such as research and development, extraordinary items, pension expense and depreciation probably distort the earnings and thereby weaken the



relationship. Factors such as size, growth, the explanatory power of the dividend-earnings regression are also important in explaining the relationship. And finally, we find that the industry factor is important in explaining the variability of the slope coefficient and its significance in the price earnings relationship.

With the analysis in this paper we shed new light into phenomena observed by other researchers. For example, we reconfirm that the slope of the price earnings regression, which is similar to the P/E ratio, is higher for larger firms (Basu [1978]). This result has usually been attributed to the better 'quality' of earnings for larger firms. Our investigation reveals that this slope is larger for firms which have a higher dividend payout ratio. Further, we observe that large firms have a higher dividend payout ratio, which fully accounts for their higher price earnings slope. We can explain this result by assuming that managements of large firms pay out a higher fraction of their earnings as dividends because of the intrinsic quality of their earnings. In other words, the dividend payout ratio perhaps, on average, proxies for the 'quality' of earnings for different firms.

The next section introduces the simple model that we use to relate earnings and prices. Section 3 discusses the firm specific factors that are used to explain the earnings price relationship. Section 4 describes the sample, the estimated data, and the main empirical results. Section 5 identifies the industry effects that alter earnings price relationships. Section 6 discusses the implications of the results and concludes the study.

## 2. Price Earnings Relationships

Accounting researchers have shown that the forecast errors in earnings are related to abnormal security returns. The question then arises whether this earnings-price relationship differs across firms? And further if they do



differ can any of the fundamental firm characteristics be used to explain these differences? To analyze these questions a simple model of the earnings price relationship is developed. The following valuation model is assumed for each firm:

$$P_{it} = \theta_i \text{Exp}_t(A_{it+k}) \quad (1)$$

where  $P_{it}$  is the stock price of firm  $i$  at time  $t$ ,  $\theta_i$  is a factor used to value the firm's expected future economic earnings  $A_{it+k}$  and  $\text{Exp}_t(\cdot)$ , the expected value at time  $t$ . As Beaver et al.[1980] point out this model can be seen as arising from more primitive settings and is therefore not unreasonable.

To use this model empirically, two further specifications are needed:

(1) A relationship between future economic earnings  $A_{it+k}$  and future accounting earnings  $e_{it+k}$  and (2) A relationship between future accounting earnings  $e_{it+k}$  and current accounting earnings  $e_{it}$ . These specifications help change the unobservable future economic earnings in (1) into the observable current accounting earnings.

A simple linear model is assumed to relate future economic earnings with the future accounting earnings

$$\text{Exp}_t(A_{it+k}) = \alpha_i + \beta_{it} \text{Exp}_t(e_{it+k}) + \tau_{it} \quad (2)$$

with the distribution of  $\tau_{it}$  to be specified.

A random walk model is assumed for accounting earnings

$$\text{Exp}_t(e_{it+k}) = e_{it} \quad (3)$$

This model has been shown to be a good descriptor of the earnings series (see Ball and Watts [1972], Watts and Leftwich [1977]).

Together these assumptions imply

$$P_{it} = a_i + b_{it} e_{it} + \epsilon_{it} \quad (4)$$

where  $a_i = \theta_i \alpha_i$ ,  $b_{it} = \theta_i \beta_{it}$  and  $\epsilon_{it} = \theta_i \tau_{it}$

There is no direct empirical validation of the relationship assumed in





(2). The specification assumed is a simple one which simultaneously satisfies certain empirically observable facts. For example, its error term precludes (4) from incorrectly suggesting that current earnings can determine prices without error. Similarly the term  $\alpha_i$  (and hence  $a_i$  in (4)) ensures that  $P_{it}$  is not negative when  $e_{it}$  is negative. Its absence implies a constant price/earnings ratio, an assumption that has been used in many empirical studies. This assumption, obviously, does not hold for very low or negative values of accounting earnings. Alternatively,  $a_i$  may be thought of as the market value of those assets held by the firm whose economic earnings are never measured or included in the accounting earnings  $e_{it}$ .

The last remaining specification needed is about the distribution of  $\epsilon_{it}$  in (4). Taking the expected value of (4) for  $P_{it+1}$  we have

$$\text{Exp}_t(P_{it+1}) = a_i + b_{it} e_{it} + \text{Exp}_t(\epsilon_{it+1}) \quad (5)$$

using (2b) and the assumption  $\text{Exp}_t(b_{it+1}) = b_{it}$ . If we assume that  $P_{it}$  follows a random walk i.e  $\text{Exp}_t(P_{it+1}) = P_{it}$  then comparing (5) and (4) we must have  $\text{Exp}_t(\epsilon_{it+1}) = \epsilon_{it}$ . So the errors  $\epsilon_{it}$  in (4) follow a random walk and hence serially autocorrelated. Direct estimations of (4) would be misspecified.

A simple technique for eliminating the autocorrelation in the residuals is to regress the first differences in prices on the first differences in earnings. In other words

$$P_{it} - P_{it-1} = (b_{it}e_{it} - b_{it-1}e_{it-1}) + \epsilon_{it} - \epsilon_{it-1} \quad (6)$$

We further assume  $b_{it} = b_i m_t$  where  $m_t$  is a temporal market factor that is constant across all firms.  $m_t$  varies because the market as a whole might, at different points in time, value future earnings differently due to changes in factors like the riskless rate of interest. The market P/E ratio is used as a measure of  $m_t$ . With this assumption (6) becomes

$$P_{it} - P_{it-1} = b_i (m_t e_{it} - m_{t-1} e_{it-1}) + \epsilon_{it} - \epsilon_{it-1} \quad (7)$$



If we assume that the first differences in the residuals are well behaved then we may estimate the slope coefficient using (7) in lieu of equation (4). In actual practice the differences in the residuals are heteroskedastic with the variance being higher when the stock prices are large. To correct for this (7) is divided by  $P_{it-1}$  to give

$$\frac{P_{it} - P_{it-1}}{P_{it-1}} = \frac{b_i(m_t e_{it} - m_{t-1} e_{it-1})}{P_{it-1}} + \delta_{it} \quad (8)$$

The focus of this paper is to determine the properties of the valuation equation (8). In this equation  $b_{it}$  may be interpreted as the response rate of the price to accounting earnings and is referred to hereafter as PRICERR (Price Earnings Response Rate). This coefficient is similar to the P/E ratio. If the estimate of PRICERR is significantly positive we can reconfirm earlier findings that accounting earnings do affect prices (Ball and Brown [1968]).

The fit of the regression equations (8) are also of great interest. The explanatory power of earnings will be high if the variance of  $\epsilon_{it}$  is low. It follows from (2) this will be true if the accounting earnings are very closely related to the economic earnings. The t-statistic of the slope coefficient of (8) referred to hereafter as PRICEEX (Price Earnings Explanatory Power) describes how important earnings are in determining the price for the particular firm.

Relationship to other studies:

Most of the prior studies analyzing the information content of earnings have used stock returns. For example Beaver et al.[1979] have used

$$\frac{P_{it} - P_{it-1}}{P_{it-1}} = b \frac{e_{it} - e_{it-1}}{e_{it-1}} + \delta_t \quad (9)$$

Substituting (4) for  $P_{it-1}$  in the denominator of the right hand side of (8) we get an equation to similar to (9). However there are two problems associated with using (9). (i) It assumes that the constant  $a_i$  is zero which



may not be true; (ii) If  $e_{it-1}$  is negative or close to zero then there is a problem with the right hand side of (9). This study also allows for the coefficient  $b$  to vary across firms.

A number of studies have either directly or indirectly extended and refined the earlier findings of Ball and Brown [1968] and Beaver et al.[1979]. These extensions vary some of the parameters of the original study; for instance Hagerman et al.[1984] looked at quarterly announcements. These studies use a cross sectional approach i.e. associate the earnings measure and security returns across firms. Their methodology implicitly assumes that the joint distribution of earnings and returns is the same for all firms (Marshall [1975]). The one common result from all these studies is the strong contemporaneous relationship between accounting earnings and security prices. This study relaxes the assumption that the earnings price relationship is the same across firms.

Other studies have looked at the cross sectional differences in the information content of earnings announcements (eg. Grant [1980], Zeghal [1984]). They have investigated the information disclosed by different firms at the time of *earnings announcement*. Differences in the accuracy of the earnings expectations were then used as the causal factor to explain the unequal security return reactions observed in the distinct firm groups. On the other hand this study is concerned with the cross sectional differences in the information content of earnings in determining security prices. The differences between the studies lie in the time period used for security price changes and in the set of firm specific variables used. For a given firm earnings might have a great influence on prices, but if the value of the earnings number to be announced is known to the market ahead of time, then the announcement period studies will fail to detect significant price changes.

Cross sectional differences in the information content of accounting



method changes have also been investigated recently (see Holthausen [1981], Leftwich [1981], Collins et al.[1983]). These studies attempt to explain either the choice of, or the reaction to, accounting method changes using firm specific characteristics. Our study, though in the same light, attempts to explain the information in accounting earnings perse, and is therefore more fundamental and basic in its focus and content.

### 3. Factors Affecting Price Earnings Response Rate(PRICERR) and Explanatory Power(PRICEEX)

In this section we propose some fundamental economic factors that may affect PRICEEX and PRICERR.

#### 3.1. Accounting Distortions:

The reported earnings of firms are the outcome of the accounting systems used. Accrual accounting convert the actual expenditures and cash inflows into revenues, expenses, assets and liabilities through accounting methods and assumptions. These methods in some sense try to portray the future revenues and expenses and hence the future income in an unbiased manner. This accounting conversion of expenditures into expense or asset figures, though unbiased, is less accurate for some than for other types of expenditures. If the expenditures of a firm are predominantly of the type which preclude accurate conversion then the earnings figures are likely to be less useful in valuing this firm. Some of these expenditures are discussed below.

*Net plant* value is based on assumptions about depreciation. The depreciation expense used in the earnings computation is only an estimate of the decrease in the value of the related assets. For more capital intensive firms there is greater uncertainty associated with the future potential value of their assets and hence earnings will be less useful in valuing these firms. We expect the ratio of net plant to total assets denoted by *CAPINT* to be *negatively related to the PRICEEX.*





*Research and Development* expenses pose a similar problem. As the future value of the current expenditures is uncertain they cause a valuation problem. This happens whether the firm capitalizes or expenses its R & D expenses. In either case the reported expense will be inaccurate and distort earnings. We expect the ratio of the R & D expenses to sales denoted *R&D* to be *negatively related to the PRICEEX*.

*Pension Expense* is a current provision to cover what the company expects it will have to pay to its retired employees in the future. This translation of expected future payments into a current expense is based on many assumptions about the employee tenure, life expectancy, interest earned by the pension funds. Consequently the current pension provision may or may not cover future pension expenditures. Accounting earnings figures which include pension expenses are likely to be distorted. The distortion is not serious if the firm has few employees or if the pension plan is small. We expect the ratio of the pension expense to total sales denoted by *PENSION* to be *negatively related to the PRICEEX*.

During the period of this study (1975-1984) the underfunding of pension funds was widely prevalent. For most firms the present value of true future expenditures was more than their reported pension expense. We propose that this difference is proportional to the firm's total pension expense and that the earnings were more overstated for firms with higher *PENSION*. We expect *PENSION* to be *negatively related to PRICERR*.

*Extraordinary income* measures the profit or loss that is unique to the reported period. It occurs usually because of discontinued operations. Let *EXTRAORD* be the absolute value of the ratio of extraordinary income to sales. If this figure is large it suggests that the firm probably keeps experimenting with diverse opportunities. For these firms earnings are likely to be a poorer predictor of price. We expect *EXTRAORD* to be *negatively related to the*



*PRICEEX*. Higher *EXTRAORD* also means that the variability in the firm's total earnings is higher. This additional risk will decrease the rate at which the earnings are evaluated by the market. We expect *EXTRAORD* to be negatively related to *PRICERR*.

### 3.2. Size :

The *size* of the firm has been proposed as a major factor in the usefulness of the reported accounted numbers. The reason posited is that large firms have many more stockholders than small firms and are more closely scrutinized by investors and regulators. They, therefore, try to make their accounting figures more representative of their future economic earnings and therefore current prices. An alternative explanation is that large firms are but a collection of many small divisions (firms), whose individual earnings are not fully correlated. The earnings of large firms are therefore more useful in predicting the security price. In either event we expect *SIZE* to be positively related to the *PRICEEX*.

Studies analyzing P/E ratios (Basu [1978]) have found that large firms have higher P/E ratios. As *PRICERR* is similar to the P/E ratio we expect *SIZE* to be positively related to *PRICERR*.

### 3.3. Earnings Amplifying Factors :

In any security valuation model (as in (3)) the *growth* in the economic earnings is positively related to the earnings multiple  $\theta$ . If the growth in accounting earnings per share is related to the growth in per share economic earnings (see Beaver and Morse [1978] and Malkiel and Cragg [1970]) then accounting earnings growth will be related to  $\theta$ . We expect *GROWTH* to be positively related to *PRICERR* (see ).

Growing firms usually have newer layers of inventories, plant and employees with shorter tenure. So their accounting figures for assets and liabilities may be closer to the economic values. As such the information



content of their accounting earnings figures are likely to be higher. We expect *GROWTH* to be positively related to the *PRICEEX*.

*Intangibles* normally arise in the balance sheet when the price paid for assets acquired is greater than their book values. This goodwill is conservatively amortized over a period of 7-20 years although most firms expect to earn returns from these assets for much longer periods. Further for many firms which have not been bought or sold the goodwill amount is not shown in the books. The earnings multiple will be larger for firms with large intangible assets. We propose that the intangible assets on the books are a good proxy for the magnitude of the true intangible assets of the firm and expect the ratio of intangibles to total assets denoted by *INTANG* to be positively related to *PRICERR*.

*Risk*, especially the systematic risk relating the returns stream to a market return index is important in determining the value of the firm. For example Beaver and Morse [1979] find that the security return beta explains some of the variations of the P/E ratios. In this study the accounting beta, relating percentage earnings growth of the firm to the percentage earnings growth of the market is used to measure *RISK*. We expect *RISK* to be negatively related to *PRICERR*.

#### 3.4. Accounting Methods:

The choice of accounting methods affects the reported earnings stream. If there exists two or more acceptable accounting methods for determining the revenues or expenses in a given period, then one method may generally overstate the earnings compared with the other. If this is true then the *PRICERR* for firms using the method that overstates earnings will be expected to be lower. For example, Beaver and Dukes [1972] find that the P/E ratio for the firms that use the accelerated depreciation method is higher than for those that use the straight line depreciation method. Three items were



considered in this study.

*Depreciation Method:* The straight line method was assumed to be the liberal method and the accelerated method the conservative method.

*Investment Tax Credit Method:* The flow through method was assumed to be the liberal method and the deferral method the conservative method.

*Inventory Method:* The FIFO method was assumed to be the liberal method and the LIFO method the conservative method.

We expect use of *Conservative Methods to be positively related to PRICERR.*

### 3.5. Dividend Earnings Relationships

Our focus so far has been to identify factors that influence the usefulness of current earnings in predicting the future operating potential of the firm. This problem is also faced by the management of the firm in determining their dividend policy. If they believe that current earnings are very useful in predicting the future operating potential of the firm then they will tie dividends more closely to current earnings. This factor i.e the relationship between dividends and earnings is therefore a good proxy for factors that determine the usefulness of current earnings, PRICEEX. Denote by DIVEX the correlation between dividends and earnings. Then we expect *DIVEX to be positively related to the PRICEEX.* Similarly suppose the response rate of the dividends to the earnings (DIVRR) is high for a firm. Then that firm must believe that earnings are understated as for each dollar of earnings the dividends go up by a larger amount. So we expect *DIVRR to be positively related to PRICERR* (Malkiel and Craig [1970]).

This relationship is also to be expected from the investor's viewpoint. As Easton [1985] postulates the only fundamental relationship is between price and dividends. He further proposes that the relationship between price and earnings exists because of the relationship between dividends and earnings.





#### 4. The Sample, Data and Results

##### 4.1 Sample Characteristics and Variable Definitions:

The sample for the study is restricted to NYSE and AMEX companies included in the Standard and Poor's Annual Industrial Compustat tape. If an industry, classified by the four digit SIC code, had fewer than 7 companies in the sample then all companies in the industry were dropped. If, on the other hand an industry had more than 10 companies then companies in the industry were dropped at random such that there were 10 companies from that industry in the final sample. The final sample included 476 companies from 54 industries, with between 7 and 10 firms in each industry.

The variables representing the various economic factors discussed in the section above were obtained from the CRSP and COMPUSTAT data bases. The definition and measurement of these variables is as follows:

1. *Capital intensity(CAPINT)*: The average of the net plant to total assets ratio during the five years 1979-1983.
2. *Research and Development expense(R&D)*: The average of the annual R&D expense to sales ratio during the five years 1979-1983.
3. *Pension expense(PENSION)*: The average of the annual pension expense to sales ratio during the five years 1979-1983.
4. *Extraordinary expense(EXTRAORD)*: The average of the absolute value of the annual extraordinary expense to sales ratio during the five years 1979-1983.
5. *Intangibles (INTANG)*: The average of the intangible assets to total assets ratio during the five years 1979-1983.
6. *Size(SIZE)*: The average market value of common shares outstanding, as on the earnings announcement date, over the ten years 1974-1983.
7. *Growth(GROWTH)*: The median growth in the annual earnings per share over the ten years 1974-1983.



8. *Risk* : The slope of the regression relating percentage growth in accounting earnings of the firm to the percentage growth in accounting earnings of a value weighted market over ten years 1974-1983
10. *Accounting Policies*: Three different accounting policy dummies used.
  - a) *Inventory Valuation Method(INVENT)*: Firms predominantly on FIFO valuation method (liberal policy) classified as one and those predominantly on LIFO method (conservative policy) as two on this variable. The average of this variable over the five years 1979-1983.
  - b) *Depreciation Method(DEPREC)*: Firms using straight line methods (liberal policy) classified as one and those using accelerated methods (conservative policy) as two on this variable. The average of this variable over five years 1979-1983. (If in a year both the methods were used then the value was set as 1.5.)
  - c) *Investment Tax Credit Method(ITC)*: Firms using flow through method (liberal policy) classified as one and those using deferral method (conservative policy) as two on this variable. The average of this variable over the five years 1979-1983.
11. *Earnings per Share*: The primary, quarterly earnings per share before extraordinary items and discontinued operations adjusted for stock splits. The earnings series is annualized by adding to the earnings per share of any quarter the earnings per share of the three previous quarters. All regressions use the annualized earnings series.
12. *Dividend-Earnings Correlation(DIVEX) and Response Rate(DIVRR)*: The correlation coefficient and the slope of the simple longitudinal regression between the annualized dividend per share and annualized earnings per share (both adjusted for stock splits) over the period 1974-1983.
13. *Prices*: The closing stock price on the day following the earnings



announcement adjusted for stock splits.

#### 4.2 Price Earnings Relationships

The slope and correlation coefficients of the price-earnings relationship represented by (8) are estimated for the 476 firms in the sample across 36 quarters. The market factor  $m_t$  is calculated as the ratio of the value weighted market price to the value weighted market earnings of the sample firms in each period. It is then scaled such that the value of the factor in the first quarter of study is 1.0. The factor varies between 0.8 and 1.5 during the 36 quarters of interest.

The results using this assumption are presented in table 1. The mean slope PRICERR is 2.999 and the mean t-statistic is 1.155. Both PRICERR and PRICEEX are positive and significantly different from zero at the 0.10 level. We find that the number of positive slope coefficients is about 78% which, using a binomial test is significantly different from 50%.

#### 4.3 Firm specific factors:

Table 1 also presents some descriptive statistics about the firm specific factors used. The first five variables are accounting ratios. As can be seen, the relationship between the earnings and dividends is significant. For 76% of the firms the correlation between earnings and dividends (DIVEX) is positive and the mean DIVEX is 0.365.

Because of lack of sufficient theory to postulate the exact form of the dependence of the price earnings relationship on firm specific variables we use only the ordinal properties of the different variables. All variables other than those for accounting methods are ranked and cross sectional regressions use these ranks.

Table 2 provides the correlation between the ranked independent variables. A few interesting observations may be made with this table. We find that firms with larger R&D expenses have larger pension expenses, and



lower levels of capital intensity. In other words, these firms are more labor intensive. Size is strongly correlated with both pension and capital intensity, but not with R&D expense. Also large firms have smaller extraordinary income. Growing firms seem to have lower pension expenses. The autocorrelation coefficient is, as postulated by Lev [1983], positively related to size, R&D expense and growth.

#### 4.4 Cross Sectional Regressions - PRICEEX:

The results of the regression relating PRICEEX (correlation coefficient) and the various explanatory variables

$$\text{PRICEEX}_i = A + \sum_j B_j V_{ij} + \epsilon_i \quad (10)$$

where  $V_{ij}$  is explanatory variable  $j$  for firm  $i$  is presented in table 3. In column A PRICEEX is regressed against the six independent variables PENSION, CAPINT, R&D, EXTRAORD, SIZE and GROWTH. PENSION, CAPINT and GROWTH are statistically significant, with the expected sign, at the 0.01 level, with R&D and EXTRAORD at the 0.05 level. Size, because of the scaling of both the dependent and independent variable by price, is not significant. The factors together explain 13% of the variations in the explanatory power of the earnings.

However, when a seventh independent variable, the correlation coefficient (DIVEX) relating earnings and dividends, is introduced into the regression, the significance of a number of variables decreases (Column B). The DIVEX variable is by itself extremely significant in explaining the PRICEEX. R&D, and EXTRAORD are no longer significant. The size variable is negatively related to PRICEEX and significant at the 0.05 level. CAPINT, PENSION and GROWTH appear to directly influence the PRICEEX variable in a significant manner. These variables together explain 20% of the variations in PRICEEX.

To explore this change in significance further, a third multiple





regression of DIVEX against the other six independent variables is run (Column C). This confirms that the value of DIVEX is strongly influenced by R&D, SIZE, EXTRAORD and GROWTH. The relationship suggests that large growing firms with low R&D expense and extraordinary income tend to tie their dividends more closely with their earnings. R&D, and SIZE influence PRICEEX solely through their influence on the dividend policy(DIVEX).

#### 4.5 Cross Sectional Regressions - PRICERR

The results of the regression relating PRICERR against the cross sectional characteristics of the firm is presented in Table 4. In Column A PRICERR is regressed against six firm specific variables and three different accounting methods. Four variables viz., PENSION, EXTRAORD, SIZE and GROWTH are statistically significant at the 0.01 level and have the predicted sign. Of the three accounting methods, viz., DEPREC, INVENT and ITC only DEPREC and ITC have the expected sign and are statistically significant at the 0.05 level.

As with the cross sectional analysis of PRICEEX discussed above, DIVRR which is the slope in the regression relating earnings and dividends, is introduced next into the regression(Column B). The coefficient of DIVRR is extremely significant and its introduction increases the correlation coefficient of the multiple regression considerably, from 0.19 to 0.27. It also results in SIZE which was statistically significant in the original regression at the 0.01 level to becoming insignificant. The RISK variable which was not significant in the first regression is now significant at the 0.05 level with the right sign. All other variables, except INTANG, are significant explanators of PRICERR at least at the 0.05 level.

A regression of the DIVRR variable against the other six independent variables, DEPREC and ITC clearly explains the reasons for this result (Column C). It demonstrates that SIZE is an extremely important determinant of the



dividend response rate(DIVRR). Also riskier firms have a larger DIVRR. The ITC variable is significant mainly because of the correlation between size and ITC accounting method.

## 5 Industry Analysis:

### 5.1 PRICEEX Regressions (including industry specific dummies):

The next step in the analysis is to identify if there exist systematic differences in the price earnings relationships across industries. The following regression using a dummy variable for the industry is estimated first

$$\text{PRICEEX}_i = \sum_k D_{ik} A_k + \epsilon_i \quad (11)$$

where  $k$  denotes the industries and  $D_{ik} = 1$  if firm  $i$  belongs to industry  $k$  and  $= 0$  otherwise. The explanatory power (multiple correlation coefficient) of this regression is 0.22 (F statistic 13.2). This obviously means that the industry factor is an important determinant of the price earnings relationship and should therefore be introduced as an explanatory variable.

This is done by introducing industry specific dummies instead of a single constant term in the cross sectional equation (10). We therefore have:

$$\text{PRICEEX}_i = \sum_k D_{ik} A_k + \sum_j B_j V_{ij} + \epsilon_i \quad (12)$$

For the sake of computational tractability we do not actually use equation (12). Instead we estimate all coefficients of the equation except the industry specific dummies by using the equation given below (see Murphy [1984]).

$$(\text{PRICEEX}_i - \sum_k D_{ik} \text{PRICEEX}_k) = \sum_j B_j (V_{ij} - \sum_k D_{ik} V_{kj}) + \epsilon \quad (13)$$

where  $\text{PRICEEX}_k$  is mean PRICEEX for the firms in industry  $k$  and  $V_{kj}$  is the mean of explanatory variable  $j$  for industry  $k$ . This equation relates the variations within the industry. The explanatory power (multiple correlation coefficient) of this regression is 0.13. The correlation coefficient of



equation (12) is easily determined by adding the correlation coefficient of equation (11) with the product of that for equation (13) multiplied by the unexplained portion of equation (11) i.e.  $0.22 + 0.13(1-0.22) = 0.32$  (see figure 1)

From Table 3 column D, we see that the inclusion of industry specific dummies increases the correlation coefficient of the cross sectional regression from 0.195 to 0.316. In the new regression the significance levels of most slope coefficients drops appreciably. The explanation for this drop is that there exist systematic differences in the magnitude of the explanatory variables across industries. We test this by regressing the mean industry PRICEEX variable on the mean industry explanatory variables.

### 5.2 Industry PRICEEX:

Table 5 (similar to table 3) reports the regression results using the industry mean PRICEEX as the dependent variable. The regression (Column A) using the seven variables other than DIVRR can be expressed as

$$\text{PRICEEX}_k = A + \sum_j C_j V_{kj} + \epsilon_k \quad (14)$$

All the estimated coefficients are of the predicted sign. CAPINT and GROWTH are statistically significant at the 0.01 level, EXTRAORD at the 0.05 level and R&D at the 0.10 level. PENSION and SIZE are not statistically significant. The correlation coefficient of the regression (0.376) is much higher than that for the regression in Table 3 (0.135). The t-statistics of the variables and the F statistic of the regression are less significant, primarily because of the fewer number of sample points in the regression (54 industries versus 476 firms in table 3).

Adding the DIVEX variable increases the correlation coefficient to 0.457 (Column B). As in table 3, with the addition of this variable, the significance of R&D and SIZE variables reduce drastically with the former no longer significant at the 0.10 level. The regression of DIVEX and the other



six independent variables (Column C) confirms that industries with large, growing firms and low R&D tie their dividends more closely to earnings.

In other words, these results indicate that the explanatory variables used in the cross sectional regression explain 45.7% of the variations in PRICEEX across industries. A look at figure 1 clearly demonstrates how the inclusion of the industry factor as an explanatory variable in effect increases the correlation coefficient of the cross sectional regression from 20% (10%+10%) to 32%. A Chow test indicates that this increase has a F-statistic = 9.7, which is statistically significant at 0.01 level.

The question naturally arises as to why the industry factor is important in explaining the differences in PRICEEX across firms over and above the explanatory variables. The explanation is that there are other explanatory variables (not considered in this study) which differ systematically across industries and are important in explaining cross sectional differences in the price earnings relationship.

### 5.3 PRICERR Regressions (including industry specific dummies):

To determine the slope and correlation coefficients in the cross sectional regression for PRICERR using industry specific dummies, we use the same methodology used above for PRICEEX. A regression similar to (11) for PRICERR using only industry dummy variables yields a multiple correlation coefficient of 0.32. A regression similar to (13) for PRICERR relating only the variations within industries yields a multiple correlation coefficient of 0.16. The correlation coefficient of equation (12) for PRICERR is easily determined by adding the correlation coefficient of equation (11) for PRICERR with the product of that for equation (13) for PRICERR multiplied by the unexplained portion of equation (11) for PRICERR i.e,  $0.32 + 0.16(1-0.32) = 0.43$  (see figure 2)

From table 4, column D we see that the correlation coefficient of the





regression increases to 0.431 from 0.272 (column B). Further the t statistics of the coefficients are in general less significant in this regression compared to those in column B. For example, EXTRAORD and ITC are both significant at the 0.01 and 0.05 level, respectively, in column B but are not significant at all in column D. Here, as for PRICEEX, we propose that the drop in significance is due to the systematic differences in the magnitude of the explanatory variables across industries. We, therefore, regress the mean industry PRICERR on the mean industry explanatory variables.

#### 5.4 Industry PRICERR:

From the results in Table 6, we can see that the cross sectional results at the firm level (Table 4) for PRICERR carry over to the industry level. Of the nine independent variables used in the first regression, one is statistically significant at the 0.01 level, three at the 0.05 level and two at the 0.10 level (Column A). The correlation coefficient of the industry regression (0.434) is, however, much higher than that for the firm regression (0.186).

Including the industry mean DIVRR increases the correlation coefficient of the regression to 0.492(Column B). The SIZE variable continues to be insignificant. The regression between DIVRR and the other independent variables confirms that there exists a strong relationship between DIVRR and SIZE (Column C). In other words industries with large firms tend to have higher payout ratios.

These results indicate that the explanatory variables used in the cross sectional regression explain 49.2% of the total across industry variations in PRICEEX. A look at figure 2 clearly demonstrates how the inclusion of the industry factor as an explanatory variable in effect increases the correlation coefficient of the cross sectional regression from 27% (11%+16%) to 43%. A Chow test indicates that this increase has a F-statistic = 16.1, which is



statistically significant at 0.01 level. The importance of the industry factor in explaining variations in PRICERR is once again due to the omission of other explanatory variables in the cross section regression.

#### 6.0 Implications and Summary:

The purpose of this paper is to extend the results of previous studies which find that earnings incorporate information that affect security prices. We do this by analyzing whether the information content of earnings differs systematically across firms. The explanatory power of earnings (PRICEEX) and the response rate of security prices to earnings (PRICERR) are computed for each firm using time series regressions. We postulate that some fundamental firm specific factors will affect PRICEEX and PRICERR and find evidence supporting our hypotheses.

This study differs from most of the earlier studies in that the security price is directly used to explain the information content of earnings. This avoids the problems of scaling when earnings are low or negative.

6.1 The explanatory power of earnings (PRICEEX): The accounting system translates cash inflows and outflows into revenues, expenses, assets and liabilities. The assumptions inherent in the accounting system though reasonable and unbiased could distort the economic earnings of the firm and thereby limit the usefulness of earnings in predicting future cash flows for the firms. We hypothesize that the distortion will be higher if the firm has large cash flows in an account category least amenable to accurate translation. We find that higher a firm's capital intensity, research and development expenses, pension expenses and absolute value of extraordinary expenses the lower the explanatory power of its earnings. For these firms the market relies less on earnings in determining the prices.

A major objective of accounting standards regulation is to make



accounting earnings useful for security valuation. Considerable discussion has centered on the four issues viz., depreciation, R&D, pension and extraordinary expenses. The results of this paper show that this emphasis is not misplaced.

Grant [1980] and Zeghal [1984] found that the security price reaction at the time of earnings announcement was greater for smaller firms. They have explained this by showing that the market's earnings expectations are less accurate for smaller firms. This study, on the other hand finds that the influence of earnings in determining security prices is greater for larger firms. This implies that the results from the earlier studies are understated.

We also find that the industry to which a firm belongs influences the explanatory power of its earnings. This gives a rationale for designing industry specific accounting standards.

Another interesting finding is that the correlation between price and earnings is strongly influenced by the correlation between dividends and earnings. This is not surprising if we assume that the dividend earnings correlation is a signal by a firm's management about the usefulness of current earnings in predicting future cash flows. We believe the market incorporates this information when determining prices based on current earnings.

6.2 The Price Earnings Reponse Rate (PRICERR) : The response rate of the security price to the earnings is higher for growing firms and for firms that have lower levels of extraordinary income. These results conform to the predictions based on standard capitalization models. We also find that the market believes that both pension expenses and the value of intangible assets are understated.

We observe that dividend earnings response rate (DIVRR) is strongly related to PRICERR. This confirms the agreement in the beliefs about the



Table 1

Summary statistics of the variables used in the paper.

Variable	Mean	Minimum	Q1	Median	Q3	Maximum
PRICERR(slope)*	2.999	-16.61	0.1280	1.4490	4.6030	28.845
PRICEEX	1.1551	-8.030	0.1733	1.0909	2.0616	5.1760
CAPINT	0.3906	0.0040	0.2300	0.3430	0.5390	0.9220
R&D	0.2020	0.0010	0.0063	0.0140	0.0288	0.1060
PENSION	0.0100	0.0810	0.0040	0.0080	0.0150	0.0570
EXTRAORD	0.0287	0.0010	0.0030	0.0070	0.0205	0.4580
INTAN	0.0451	0.0010	0.0070	0.0235	0.0578	0.4840
SIZE (\$million)	1040	3	67	308	946	66904
GROWTH(annual %)	13.857	-12.10	3.17	12.90	22.066	84.289
RISK	1.03	-1.120	0.292	0.7780	1.660	2.6720
DIVEX	0.3648	-0.626	0.0100	0.3450	0.7465	0.9980
DIVRR	0.1553	-0.235	0.0100	0.0930	0.2565	1.2970
Accounting Methods:						
DEPREC	1.2213	1	1	1	1.5	2
INVENT	1.4567	1	1	1.3	2	2
ITC	1.1073	1	1	1	1	2

For the accounting methods, the variable definitions were

Value	1	2
DEPREC	Straight Line	Accelerated
INVENT	FIFO	LIFO
ITC	Flowthrough	Deferral

\* The slope coefficients of 374 of the 476 firms was positive.





Table 2

First order correlations among the variables used to explain cross sectional differences in the parameters of the price earnings regression

---

	CAPINT	R&D	PENSION	EXTRAORD	INTAN	SIZE	GROWTH
R&D	-0.173						
PENSION	0.096	0.261					
EXTRAORD	-0.016	0.048	-0.103				
INTAN	-0.158	0.136	-0.009	0.167			
SIZE	0.264	0.083	0.326	-0.163	-0.077		
GROWTH	-0.074	-0.034	-0.209	0.043	0.174	-0.015	
RISK	-0.019	-0.019	0.000	0.071	0.112	-0.039	0.121

---



Table 3

T-Statistics of cross sectional regressions relating both price earnings explanatory power(PRICEEX) and dividend earnings explanatory power(DIVEX) with relevant cross sectional factors at the firm level for 476 firms.

Independ. Variable:	A PRICEEX	B PRICEEX	C DIVEX	D PRICEEX
Dependent Variables				
DIVEX	NOT USED	4.85***		4.41***
CAPINT	-2.70***	-2.73***	-0.99	-0.71
R&D	-2.03**	-0.66	-4.24***	0.06
PENSION	-2.53***	-2.75***	-0.67	-2.39***
EXTRAORD	-1.68**	-0.91	-3.25***	0.03
SIZE	0.29	-1.97**	8.12***	-1.60*
GROWTH	5.77***	4.42***	4.97***	4.20***
Industry Specific Dummy Variables				
				54
R <sup>2</sup> %	13.3	19.5	24.5	31.6
F-statistic	11.5***	14.1***	22.1***	23.4***

\* Significant at the ten percent level.

\*\* Significant at the five percent level.

\*\*\* Significant at the one percent level.



Table 4

T-Statistics of cross sectional regressions relating both price earnings response rate (PRICERR) and dividend earnings response rate (DIVRR) with the cross sectional factors at the firm level for 476 firms.

Independ. Variable:	A PRICERR	B PRICERR	C DIVRR	D PRICERR
Dependent Variables				
DIVRR	NOT USED	5.84***		5.02***
PENSION	-4.93***	-4.75***	-2.21**	-2.89***
EXTRAORD	-2.71***	-2.23**	-2.25**	-1.12
INTANG	0.94	1.04	0.48	-0.31
SIZE	2.94***	-0.08	8.53***	0.01
GROWTH	4.81***	4.04***	1.90**	3.57***
RISK	-1.04	-2.02**	3.81***	-2.38***
Accounting Methods:				
DEPREC	1.88**	2.26***	-0.02	1.69**
INVENT	-0.86	-1.30	0.59	-0.31
ITC	2.16**	1.66**	1.71**	1.11
Industry Specific Dummy Variables				
				54
R <sup>2</sup> %	18.6	27.2	25.4	43.1
F-statistic	9.3***	12.5***	12.7***	21.9***

\* Significant at the ten percent level.

\*\* Significant at the five percent level.

\*\*\* Significant at the one percent level.



Table 5

T-Statistics of cross sectional regressions relating price earnings explanatory power(PRICEEX) and dividend earnings explanatory power(DIVEX) with the cross sectional factors at the industry level for 54 industries

Independ. Variable:	A PRICEEX	B PRICEEX	C DIVEX
Dependent Variables			
DIVEX	NOT USED	2.63***	
CAPINT	-2.65***	-2.34***	-1.15
R&D	-1.38*	-0.35	-2.85***
PENSION	-0.84	-0.86	-0.07
EXTRAORD	-2.13**	-1.87**	-0.96
SIZE	0.33	-0.81*	3.27***
GROWTH	2.87***	2.02**	2.36***
R <sup>2</sup> %	37.6	45.7	38.8
F-statistic	4.8***	5.6***	5.0***

\* Significant at the ten percent level.

\*\* Significant at the five percent level.

\*\*\* Significant at the one percent level.





Table 6

T-Statistics of cross sectional regressions relating price earnings response rate (PRICERR) and dividend earnings response rate (DIVRR) with the cross sectional factors at the industry level for 54 Industries

Independ. Variable:	A PRICERR	B PRICERR	C DIVRR
Dependent Variables			
DIVRR	NOT USED	2.11**	
PENSION	-2.50***	-1.96**	-1.72**
EXTRAORD	-1.76**	-1.64**	-0.56
INTAN	2.01**	1.61*	1.34**
SIZE	0.52	-0.28	2.54***
GROWTH	1.93**	2.04**	-0.09
RISK	-1.30*	-1.56*	0.65
DEPREC(Acc. Method)	1.27*	1.04	0.82
INVENT(Acc. Method)	-0.81	-0.68	-0.49
ITC(Acc. Method)	2.25**	1.65**	1.87**
-----			
R <sup>2</sup> %	43.4	49.2	34.2
F-statistic	3.4**	3.8**	2.4**

\* Significant at the ten percent level.

\*\* Significant at the five percent level.

\*\*\* Significant at the one percent level.



Figure 1  
 Cross Sectional Regressions of Price Earnings Explanatory Power (PRICEEX)  
 across Firms using Industry Factors and the Explanatory Variables



$$PRICEEX_i = \sum_k D_{ik} A_k$$

Firm variations through industry variations



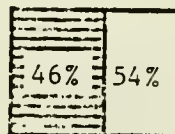
$$PRICEEX_i - \sum_k D_{ik} PRICEEX_k = \sum_j B_j \{V_{ij} - \sum_k D_{ik} V_{kj}\}$$

Within industry firm variations through variations of explanatory variables



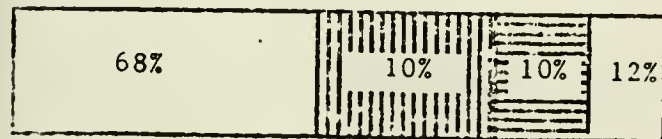
$$PRICEEX_i = \sum_k D_{ik} A_k + \sum_j B_j V_{ij}$$

Firm variations through variations of explanatory variables with industry dummies



$$PRICEEX_k = A + \sum_j C_j V_{kj}$$

Industry variations through industry variations of explanatory variables



$$PRICEEX_i = A + \sum_j B_j V_{ij}$$

Firm variations through variations of explanatory variables

**Subscripts:** i denotes the firms  
 j denotes the explanatory variables.  
 k denotes the industries

**Variables:**  $D_{ik} = 1$  if firm i belongs to industry k and  
 = 0 otherwise.

$PRICEEX_i$  and  $PRICEEX_k$  denote the price earnings explanatory power of firm i and industry k respectively.

$V_{ij}$  and  $V_{kj}$  denote the explanatory variable j of firm i and industry k respectively.



Figure 2  
 Cross Sectional Regressions of Price Earnings Response rate (PRICERR)  
 across Firms using Industry Factors and the Explanatory Variables



$$PRICERR_i = \sum_k D_{ik} A_k$$

Firm variations through industry variations



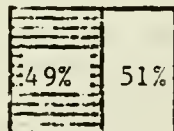
$$PRICERR_i - \sum_k D_{ik} PRICERR_k = \sum_j B_j \{V_{ij} - \sum_k D_{ik} V_{kj}\}$$

Within industry firm variations through variations of explanatory variables



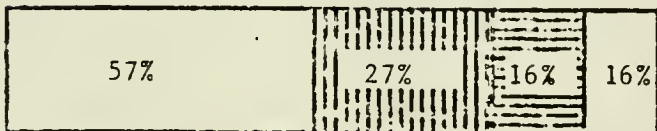
$$PRICERR_i = \sum_k D_{ik} A_k + \sum_j B_j V_{ij}$$

Firm variations through variations of explanatory variables with industry dummies



$$PRICERR_k = A + \sum_j C_j V_{kj}$$

Industry variations through industry variations of explanatory variables



$$PRICERR_i = A + \sum_j B_j V_{ij}$$

Firm variations through variations of explanatory variables

**Subscripts:** *i* denotes the firms  
*j* denotes the explanatory variables.  
*k* denotes the industries

**Variables:**  $D_{ik} = 1$  if firm *i* belongs to industry *k* and  
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$PRICERR_i$  and  $PRICERR_k$  denote the price earnings explanatory power of firm *i* and industry *k* respectively.

$V_{ij}$  and  $V_{kj}$  denote the explanatory variable *j* of firm *i* and industry *k* respectively.



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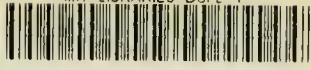
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