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MARKET RESPONSE TO EARNINGS ANNOUNCEMENTS:

THE EFFECTS OF FIRM CHARACTERISTICS

By

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ABSTRACT

MARKET RESPONSE TO EARNINGS ANNOUNCEMENTS: THE EFFECTS OF FIRM CHARACTERISTICS

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This study examines factors associated with stock price response to earnings announcements. The study is developed in two parts. First, a theoretical model of the firm is developed to identify firm-specific determinants of the market response to earnings announcements. The model allows for differential market response depending upon the past and expected future investment characteristics and performance of the firm. The model contributes to an understanding of the information which is important to the market and of the transmission process by which earnings information affects stock prices. Secondly, the factors identified in the theoretical model are empirically examined. The empirical analysis is extended to compare the relative importance of a set of response factors identified in the theoretical and empirical literature. Results show that dividend policy is an important factor associated with stock price response to earnings announcements.

dedicated to my mother, Lee Myong-Ja,
and my father, Han Seok-Woo

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Chapter 1. Introduction

This study examines factors associated with stock price response to earnings announcements. The study is developed in two parts. First, a theoretical model of the firm is developed to identify firm-specific determinants of the market response to earnings announcement. The model allows for differential market response depending upon the past and expected future investment characteristics and performance of the firm. The model contributes to an understanding of the information which is important to the market and of the transmission process by which earnings information affects stock prices. Secondly, the factors identified in the theoretical model are empirically examined. The empirical analysis is extended to compare the relative importance of a set of response factors identified in the theoretical and empirical literature.

Studies of the information content of earnings announcements have a long tradition in accounting and finance research. Early studies (e.g. Ball and Brown [1968], Beaver [1968]) determined that the sign and magnitude of stock price responses are positively correlated with the sign and magnitude of unexpected earnings. Subsequent articles document cross-sectional differences in market response to earnings announcements (Joy, Litzenberger, and McEnally [1977], Beaver, Clarke, and Wright [1979], and Grant [1980]).

More recent studies have focused on the specific factors associated with stock price response including firm size (Atiase [1985]), earnings predictability (Pincus [1983]), systematic risk (Collins and Kothari [1989]), and growth (Collins and Kothari [1989]). However, these studies have typically examined only one or two components of market response and have not examined the relative importance of the various determinants of a firm's stock price response to earnings information. This study provides a comprehensive analysis of the factors affecting the market reaction to unexpected earnings.

Using a rational expectations framework, Chapter 3 develops a two-period model of the firm similar to that proposed by Miller and Rock [1985]. This theoretical model develops the economic determinants behind firm-specific differences in market response to earnings announcements. In the model, the firm bases its investment decisions on the intersection of its investment opportunity schedule with its cost of capital schedule. The firm continues to invest until the expected marginal return on capital is equal to its marginal cost of capital. Because of uncertainty, the firm cannot guarantee that the chosen level of investment is optimal. When actual investment outcomes deviate from the expectations, the firm reflects this information in its investment decision in the following period.

The unexpected investment outcome is realized as unexpected earnings. If the unexpected earnings are positive, it implies that the investment level was below the optimal level. Consequently, the firm will adjust its next period investment upward expecting identical marginal return and cost and, therefore, higher expected net return in the next period. Since the market is aware of this, the share price of the firm should increase with positive unexpected earnings. On the other hand, if unexpected earnings are negative, the share price of the firm should decrease.

This two-period model is then extended into a multi-period setting within the rational expectations framework. Both the two-period model and the multi-period model suggest that market response to unexpected earnings is a function of Tobin's q ratio, cost of capital, and dividend policy.

The theoretical model is translated into an empirical regression equation in Chapter 4. The regression results of Chapter 5 are then extended in Chapter 6 to include factors identified by the empirical literature as being important but which are not implied by the theoretical model.

The theoretical and empirical results of this study indicate that dividend policy is a key determinant of market response to an earnings announcement. Unexpected earnings and dividend policy together provide useful information to the market concerning management's inside information about unrealized investment opportunities.

This study provides evidence which is contrary to the empirical findings of some previous research. First, the results show that market beta does not impact the return/surprise relation. This is inconsistent with Collins and Kothari [1989]. Second, the results indicate that earnings predictability is related to market reaction but that its relational direction is opposite that suggested by Pincus [1983]. Finally, earnings growth turns out to be an unimportant factor in the return/surprise relationship which is inconsistent with Collins and Kothari [1989].

More importantly, the equity market reaction is asymmetric between positive and negative earnings surprises. The response is stronger to positive earnings surprise.

This study is organized as follows. In Chapter 2, previous theoretical and empirical studies of market reactions to earnings announcements are reviewed with an emphasis on recent studies associating firm characteristics with market response. Chapter 3 develops a two-period model within a rational expectations framework. The two-period model is then extended into a multi-period model. In Chapter 4, the theoretical model is translated into an empirical specification. Chapter 4 also identifies the sample used in this study. Empirical results are reported in Chapters 5 and 6. Chapter 7 summarizes the empirical findings and discusses some of the implications for past and future research.

Chapter 2. Market Response to Unexpected Earnings

A fundamental issue at the interface of finance and accounting involves the relationship between a firm's reported earnings and its stock returns. One question that has received considerable attention is whether reported earnings contain information used by the market in assessing the value of a firm's common stock. Since the seminal work of Ball and Brown [1968], numerous studies have addressed this question by examining the contemporaneous relationship between stock returns and unexpected earnings. The results of this large body of research provide convincing empirical support for the information content of accounting earnings. A number of recent studies provide evidence that the market's response to unexpected earnings varies across firms. As an attempt to understand these cross-sectional differences, several recent studies turn to firm characteristics such as firm size, earnings predictability, systematic risk, and growth.

Share price reaction to earnings announcements may be classified into contemporaneous, leading, and lagging responses. Leading and lagging price responses are important from a market efficiency perspective and in assessing the value of accounting earnings. This study focuses on the contemporaneous response of price to earnings announcements. While the perspective of this study is consistent with market efficiency, the empirical models of Chapters 4 through 6 require no assumption of efficiency. Furthermore, this study focuses on share price response to earnings surprises.

2.1. The Market's Earnings Expectation

The theoretical and empirical literature focuses on the relationship between unexpected earnings and share price. Unexpected earnings is defined as actual earnings minus the market's expectation of earnings. Examination of unexpected earnings requires some proxy for the market's expectation of earnings. Unfortunately, there exists no underlying theory for the specification of market expectation of earnings. Many early studies employ expectational models based on the past time-series behavior of earnings. More recent studies employ financial analysts' earnings forecasts which have been shown to be superior to time-series expectational models.

2.1.a. Time-series Models

Since little established theory guides the selection of an earnings expectations model, many researchers use a set of time-series models. Time-series models which have been applied to earnings expectations can be broadly categorized into univariate time-series models and index models.

Within the class of univariate time-series models, Box-Jenkins [1976] models are highly regarded for their ability to make the most efficient use of time series data. A general Box-Jenkins model has the following form:

$$E_{t-1}(X_t) = f(X_{t-1}, X_{t-2}, \ldots.),$$

where

$E_{t-1}(.)$ = forecast of (.) made at time t-1,
X_t = realized earnings at time t.

The Box-Jenkins modelling technique enables one to select the most appropriate time series model consistent with the process generating each firm's time series of earnings. The Box-Jenkins model, by not making 'a priori' assumptions about the process generating earnings, subsumes autoregressive, moving average and mixed models as special cases of the general model. There are a number of other time-series models such as random walk models, martingales, and seasonal martingales which are special cases of the general Box-Jenkins model (see Brown and Rozeff [1978]).[1]

An index model has the following general form:

$$E_{t-1}(X_t) = X_{t-1} + a_t + b_t E_{t-1}(X_{mt} - X_{mt-1}),$$

where the index X_{mt} is usually defined as the market's average earnings. The use of this model is motivated by the relationship that is found between first-differenced individual company earnings and a first-differenced economy-wide index of earnings such as average earnings across all firms. By applying OLS, coefficients a_t and b_t are obtained.

[1] Various forms of univariate time-series models are found in Kiger [1974], Elton and Gruber [1972], Joy, Litzenberger, and McEnally [1977], Beaver, Clarke, and Wright [1979], and Brown et al. [1987a].

Since Ball and Brown's [1968] seminal investigation of the information content of earnings, a number of studies have used this model (Beaver [1968], Beaver, Clarke, and Wright [1979], and Fried and Givoly [1982]).

2.1.b. Analysts' Forecasts

Information content studies using analysts' forecasts as a proxy for the market's earnings expectation rely on the assumption that market participants use analysts' earnings forecasts in stock valuation models. A considerable body of circumstantial evidence suggests that this is the case (e.g. Givoly and Lakonishok [1984]). Annual and/or quarterly earnings forecasts are provided to the market by major brokerage houses and other financial service firms. Sources of analysts' forecasts used by the investment community include the Value Line Investment Survey, Standard and Poor's Earnings Forecaster, and the Institutional Brokers Estimate System (I/B/E/S) of Lynch, Jones and Ryan.[2]

2.1.c. Analyst Superiority Relative to Time-series Models

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[2] Studies employing these sources of analyst forecasts include:

Value Line - Brown and Rozeff [1978], Brown et al. [1987a], Brown, Richardson, and Schwager [1987], and Brown et al. [1987b],

S & P - Givoly and Lakonishok [1979], and Fried and Givoly [1982],

I/B/E/S - Elton, Gruber, and Gultekin [1984], Brown, Richardson, and Schwager [1987], and O'Brien [1988].

The selection of a time-series model as a surrogate for market expectations is impaired by the underlying assumptions that earnings generating processes are stationary and that the model characteristics are applicable to all firms. Recent empirical evidence (e.g. Brown, Richardson, and Schwager [1987]) indicates that analysts' earnings forecasts are a better surrogate for the market expectation of earnings than time-series models.

Intuitively, it can be argued that analysts' forecasts have an edge over time-series models because analysts utilize all publicly available information while time-series models rely exclusively on past earnings. Analysts use a broader information set which includes non-accounting information on the firm, its industry, and the general economy.

Empirically, however, early comparisons of analysts' forecasts to time-series models conclude that analysts' forecasts are not more accurate than time-series forecasts. Cragg and Malkiel [1968] compare five-year earnings growth rates forecast by five investment houses with two sets of naive models, one predicting no change and the other a change equal to past change. The results indicate that forecasts based on the naive models do not perform better or worse than the analysts' predictions. Elton and Gruber [1972], comparing time-series models to annual earnings forecasts made by analysts in a large pension fund, an investment advisory service and a big brokerage house, reach a similar conclusion. But the period over which the performance of the competing models is compared is very short for both of these studies. Later studies employing more refined techniques and longer test periods find that analysts' forecasts are superior to the prediction of time-series models. Brown and Rozeff [1978] and Collins and Hopwood [1980] compare the performance of Value Line forecasts for up to five quarters ahead with forecasts made by fairly sophisticated time series models and find that the Value Line forecasts are more accurate. Collins and Hopwood [1980] find that Value Line predictions produce fewer extreme errors. Using Standard and Poor's Earnings Forecaster, Fried and Givoly [1982] compare the accuracy of analysts' annual earnings per share estimates with a univariate time-series model and an index model. Results show that the analysts' forecasts are more accurate, on average, than the timeseries models. The analysts' forecasts had a mean relative absolute error over the test period of 16.4 per cent. This was significantly lower than the mean error of either the univariate time-series model (19.3 per cent) or the index model (20.3 per cent). In more recent studies, Brown et al. [1987a] (Value Line), and Brown, Richardson, and Schwager [1987] (Value Line and I/B/E/S) reach similar conclusions.

2.2. Information Content of Unexpected Earnings

2.2.a. Unexpected Annual Earnings

The Ball and Brown [1968] study provides the first comprehensive evidence of the adjustment of stock prices to earnings announcements. For a sample of 261 COMPUSTAT firms over the period 1946 through 1968, each annual earnings announcement is classified either as favorable or as unfavorable using an index model. Abnormal risk-adjusted monthly rates of return for these two groups are examined.[3] The major finding is that positive (negative) earnings forecast errors are associated with positive (negative) abnormal returns. The information content of unexpected earnings is supported by Beaver [1968] in a different way. Using abnormal weekly returns of 143 firms over the period of 1961-1965, he shows that the magnitude of stock returns during the weeks in which an earnings announcement is made is much larger than those during the nonreport period. However,

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[3] Stock price movements are measured by the abnormal monthly returns where the expected return is defined according to the market model,

$$E(R_{it}) = a_i + B_iR_{mt},$$

where R_{it} denotes the return of security i for period t, a_i and B_i are parameters and R_{mt} is the actual market rate of return for period t. Monthly abnormal returns are measured by the difference

$$u_{it} = R_{it} - E(R_{it}),$$

where a_i and B_i are estimated by the OLS.

neither Ball and Brown [1968] nor Beaver [1968] provide insight into whether abnormal returns vary with the magnitude of the forecast error.

While Ball and Brown [1968] investigate the association between the sign of the earnings forecast errors and abnormal stock returns, Beaver, Clarke, and Wright [1979] also consider the magnitude of the forecast error. Their sample of earnings announcement-stock return pairs is categorized into 25 nonoverlapping groups based on the size of forecast errors obtained by an index model and a martingale model with drift. Significance tests are conducted based on an ordinal (rank-order) relationship between monthly returns and forecast errors. The magnitude of stock price response to an earnings announcement is significantly associated with the magnitude of the earnings surprise.

2.2.b. Unexpected Quarterly Earnings

A study by May [1971] assesses whether quarterly earnings announcements have a significant impact on market prices. His results indicate that the magnitude of price changes in announcement weeks is greater than the magnitude of price changes in nonannouncement weeks, and support Beaver's [1968] study. May [1971] does not attempt to distinguish between favorable and unfavorable earnings reports. Kiger [1974] also presents evidence that there are substantial price reactions to quarterly earnings announcements for a sample of 87 firms

(1966-69).

Joy, Litzenberger, and McEnally [1977] further develop the association between the sign and magnitude of stock returns and those of earnings forecast errors. In their study, martingale models are used to categorize observed earnings announcements as favorable, neutral, or unfavorable. For each earnings announcement, weekly rates of return are observed. Unanticipated quarterly earnings announcements are shown to have a statistically significant association with abnormal price changes over the subsequent twenty weeks. More importantly, the percentage deviation of reported earnings from the expectation is shown to have a significant association with the magnitude of the subsequent price adjustment.

2.3 Cross-sectional Differences

Ball and Brown [1968] find that, while on average the sign of earnings forecast errors is associated with the sign of abnormal stock returns, not all firms that have positive (negative) earnings forecast errors have positive (negative) abnormal returns. Joy, Litzenberger, and McEnally [1977] suggest that differences in magnitudes as well as signs of earnings forecast errors are associated with differences in abnormal stock returns. But stock returns behavior around earnings reports is not fully explained by earnings forecast errors.

Grant [1980] assesses the differences in the information content of annual earnings announcements between a sample of OTC firms and a sample of NYSE firms based on the notion that the amount of interim information available on OTC firms may be systematically less than that available on NYSE firms. He argues that OTC investors rely more heavily on the earnings announcement as a source of information for decision making. Following Beaver's methodology, Grant compares the price response to earnings announcements of OTC and NYSE firms. Results reveal that the annual earnings announcements of OTC firms possess more information content, as measured by share price response, than those of NYSE firms. His findings support the argument that differences in prior knowledge about firms lead to cross-sectional differences in stock market behavior associated with earnings announcements.

More recently, Kormendi and Lipe [1987] contend that differences in time-series properties of accounting earnings result in cross-sectionally different reactions to earnings reports. To empirically estimate how stock prices respond to earnings changes, Kormendi and Lipe [1987] adopt the following model for each of 145 firms (1947-80):

$$R_{it} = a_{0i} + a_{1i}*(UX_{it}/P_{it-1}) + e_{it},$$

where

R_{it} = abnormal annual return for firm i and period t
UX_{it} = unexpected annual earnings for firm i and period t
P_{it-1} = price of firm i's stock at time t-1.

Kormendi and Lipe [1987] estimate the above equation for each firm. Results show that a_{1i} (market response to unexpected earnings) varies across firms.

2.4. Firm Characteristics as Explanatory Factors

Several recent studies examine firm characteristics in an attempt to understand the cross-sectional differences in share price response to unexpected earnings. Firm characteristics which have been identified as influencing share price response include firm size (Atiase [1985] and Freeman [1987]), earnings predictability (Pincus [1983]), systematic risk (Collins and Kothari [1989]), and earnings growth (Collins and Kothari [1989]).

2.4.a. Firm Size

The differential information hypothesis (e.g. Freeman [1987]) suggests that differences in prior knowledge about firms, due to differential availability of information relevant for the assessment of share value, are one reason to expect cross-sectional differences in stock market behavior associated with earnings announcements. An earnings announcement for a less widely-followed firm is likely to provide proportionally more information than an earnings announcement for a widely-followed firm. Under this hypothesis, an earnings announcement results in more stock price response for the less widely-followed firm. Thus, information availability is inversely related to stock variability at the time of an earnings announcement.

Atiase [1985] uses firm size as a proxy for differential information.[4] With weekly stock returns, Atiase [1985] examines security price revaluations in response to second-quarter earnings reports of 200 firms in 1971 and 1972. Regression analysis is used to test the hypothesis that the degree of a firm's price revaluation is inversely related to its market capitalization. For this purpose he dichotomizes his sample into large and small firms. The former group consists of 100 large NYSE/AMEX firms. The latter group is made up of 50 smaller NYSE/AMEX firms and 50 OTC firms.

To measure price revaluations in response to earnings reports, Atiase uses three alternative indices: RI (Revaluation Index), SRI1, and SRI2 (Standardized Revaluation Indices One and Two). Atiase identifies a test period and an estimation period consisting of the 104 weeks prior to the test period. The test period is divided into a predisclosure period and a report period consisting of seven weeks surrounding the second-quarter earnings report date (ranging from three weeks before the announcement week to three weeks after). Two alternative definitions are used for the predisclosure period. The predisclosure period is defined as the period between the beginning of the fiscal year and either 1) the beginning of the report period or 2) the end of the second quarter. If a firm has a December 31 fiscal year-end, it has the following time horizon for the 1971 second-quarter

[4] Bamber [1986] suggests that private-search activities are concentrated on relatively large firms.

earnings report:

```
      Estimation Period (EP)          Test Period (TP)
           (104 weeks)

  I-----------------------I---------------------------I
                      December 31
                          1970

                                Predisclosure      Report
                                 Period (P)      Period (RP)
                                                  (7 weeks)
          alternative 1       I----------------I----------I

                                Predisclosure
                                 Period (P')

          alternative 2       I----------------I
                                            June 30
                                              1971
```

Using the estimation period, the market model's coefficients are estimated:

$$R_{it} = a_i + B_i R_{mt} + e_{it} \qquad \begin{array}{l} i = 1 \ldots N \text{ (firms)} \\ t = 1 \ldots T \text{ (weeks)}, \end{array}$$

where e_{it} = stochastic individual component of R_{it}.

Estimated coefficients are used to compute u_{it}, the unexpected price change during the test period as follows:

$$u_{it} = R_{it} - (a_i + b_i R_{mt}).$$

The three revaluation indices are given below:

$$RI_{it*} = \frac{u_{it*}^2}{C_{it*} S_i^2} \cdot \frac{T - 4}{T - 2}, \qquad t* \text{ belonging to RP},$$

$$SRI1_{it} = \frac{RI_{it*}}{\frac{1}{P_i}\sum_{t=1}^{P_i} RI_{it}} \cdot \frac{P_i - 2}{P_i}, \quad \begin{array}{l} t* \text{ belonging to RP,} \\ t \text{ belonging to P,} \end{array}$$

$$SRI2_{it} = \frac{RI_{it*}}{\frac{1}{P_i'}\sum_{t=1}^{P_i'} RI_{it}} \cdot \frac{P_i' - 2}{P_i'}, \quad \begin{array}{l} t* \text{ belonging to RP,} \\ t \text{ belonging to P',} \end{array}$$

where

S_i^2 = sample variance of e_{it} for the estimation period,

$$C_{it*} = 1 + \frac{1}{T} + \frac{(R_{mt*} - \bar{R}_m)^2}{\sum_{t=1}^{T} (R_{mt} - \bar{R}_m)^2}.$$

RI measures the ratio of new information conveyed to the market by the earnings report to the average information over the estimation period for a given firm. Thus, an RI greater than 1.0 would imply that the earnings report conveyed more than average information during the estimation period. Results show that all three indices are significantly higher for small firms than for large firms.

Atiase then specifies three regression models as follows:

Model 1 : $RI_i = a_0 + a_1 LCV_i + d_i$,

Model 2 : $SRI1_i = a_0 + a_1 LCV_i + d_i$,

Model 3 : $SRI2_i = a_0 + a_1 LCV_i + d_i$,

where LCV_i = natural logarithm of market value of firm i's common stock.

In all the regression models, the estimated coefficients (a_1) of the capitalized value variable LCV_i are negative and statistically significant at an alpha level of 0.0001. These results are consistent with the hypothesis that the degree of a security's price revaluation in response to its second-quarter earnings announcement is inversely related to the capitalized value of the firm, ceteris paribus.

Atiase's [1985] differential information hypothesis is further examined by Freeman [1987]. Based on the notion that private information production increases with firm size, Freeman [1987] examines whether the magnitude of abnormal returns is inversely related to firm size. While Atiase [1985] ignores the direction of stock price change, Freeman [1987] investigates the relationship between the sign and magnitude of stock price changes and firm size.

Freeman's sample (2263 firm-year observations covering 1966 - 1982) is divided into the following four portfolios: large firms with good news (positive unexpected return on equity), large firms with bad news (negative unexpected return on equity), small firms with good news, and small firms with bad news. In each year, large firms are the top market value quartile of all firms. Large firms are then ranked by change in return on equity (dROE). The top dROE quartile forms the large-firm good-news portfolio while the lowest dROE quartile forms the large-firm bad-news portfolio. For each year of dROE classifications, separate portfolios of large (L) and small (S) firms are constructed of long positions in good news firms and short positions in bad news firms. Average abnormal returns (AAR) are computed over the interval beginning 24 months prior to the end of the fiscal year and ending twelve months after the end of the fiscal year. The AAR in month t = 1, ... 36 for a portfolio of large firms with i = 1, ...I good news stocks and k = 1, ... K bad news stocks in year y is written as

$$AAR(L)_{yt} = (1/I) \sum_{i=1}^{I} AR_{iyt} - (1/K) \sum_{k=1}^{K} AR_{kyt},$$

where AR_{iyt} is abnormal return $(R_{iyt} - (a_{iy} + B_{iy}R_{myt}))$.

Then cumulative average abnormal returns (CAAR) are computed for each month t = 1, ... 36 for large firms.

$$CAAR(L)_{yt} = \sum_{r=1}^{t} AAR(L)_{yr}.$$

CAAR(S) is computed in an analogous manner for the lowest market-value quartile of firms. Freeman [1987] tests whether CAAR(S) exceeds CAAR(L).

Results show that CAAR(S) significantly exceeds CAAR(L) at the 0.05 level for months 19 through 36. Also, a matching technique is performed to see if the higher CAAR(S) is due to the relatively high volatility of small-firm earnings. Results for the matched subsample support the inverse relationship between firm size and share price response.

2.4.b. Earnings Predictability

Based on the notion that return variability at the time of the earnings announcement should increase (decrease) as the precision of the announcement increases (decreases) relative to the precision of the prior information set, Pincus [1983] hypothesizes that hard-to-predict earnings announcements should exhibit greater return variability than easy-to-predict announcements.[5] In other words, easy-to-predict announcements provide less news at the announcement than hard-to-predict announcements so that the easy-to-predict announcements are less valuable than those of hard-to-predict earnings.

Pincus [1983] employs the Earnings Predictability (E.P.) Index, published as part of Value Line's Investment Survey, as a proxy for earnings predictability. This index is based on the standard deviation of percentage changes of earnings over a five year period. Value Line ranks firms from 5 to 100 in intervals of 5 with the highest number representing the most predictable earnings. A high E.P. Index value implies that individuals' priors regarding the dollar amount of firms' forthcoming earnings releases reflect little remaining uncertainty. Conversely, individuals' priors of firms receiving low E.P. Index values reflect high degrees of remaining uncertainty regarding the dollar amount of an

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[5] Precision is, in Pincus's [1983] words, referred to as the extent that uncertainty is reduced by an announcement.

upcoming earnings announcement. Within his framework it is expected that price change variability is inversely related to the E.P. Index.

Pincus [1983] identifies an estimation period and a forecast period. The forecast period is divided into a nonannouncement period and an announcement period:

```
     Estimation period              Forecast period
         (60 weeks)
  I----------------------I-------------------------------I

                           Nonannouncement   Announcement
                               period           period
                         I----------------I--------------I
```

A forecast period begins with the first trading day of the week following the week of the announcement of the preceding quarter's earnings, and ends with the last trading day of the week immediately prior to the week of the announcement of the current quarter's earnings. Using the estimation period, the market model's coefficients are estimated and the estimated coefficients are used to compute abnormal returns in the nonannouncement and announcement periods. As a proxy for price change variability, Pincus [1983] uses the ratio of variance of abnormal returns in the announcement period to variance of abnormal returns in the nonannouncement period. Based on the price change variability, a sample of 136 firms (1978-1979) are grouped into a large price change (in absolute value) group and a small price change group. Also, the sample is divided into an easy-to-predict group and a hard-to-predict group based on the E.P. Index. Tests are conducted on the independence of hard and easy predictability versus small and large price change groups.

Results of a nonparametric rank correlation test provide weak support (significance at the 0.09 level) for the hypothesis for interim (1st, 2nd, and 3rd quarter) announcements. Significance at the 0.05 level is indicated for annual announcements, but the directional relation is opposite that predicted. Another nonparametric test based on relative frequency histograms provide the same results: hard-to-predict firms are associated with large price changes for interim announcements but the reverse is observed for annual announcements.

As one explanation of the inconsistency between interim and annual announcements, Pincus [1983] suggests that easy-to-predict annuals are announced an average of three and one-half trading days earlier than hard-to-predict annuals such that early earnings announcements provide information useful in revising priors regarding the earnings of later-announcing firms. However, for quarterly announcements, he argues, hard-to-predict announcements are announced less than one day earlier than easy-to-predict announcements. Thus he maintains that the results for annuals are not valid because the results are confounded by the early/late-announcing phenomenon.

Pincus [1983] concludes that the interim announcement results support his hypothesis.

2.4.c. Systematic Risk

If information about earnings is an important element in valuing equity, then earnings announcements trigger price adjustments to the extent that the announced earnings realizations differ from those anticipated by the market. The direction and size of the price adjustments depend on how the market forms its anticipations. Assuming that the market's anticipation of earnings is consistent with rational expectations in the sense of Muth [1961], Miller and Rock [1985] derive a two-period model describing the earnings announcement effect. The model suggests that price change following the disclosure of a firm's earnings is a function of earnings surprise, the market required return, and a persistence parameter:[6]

$$P_1 - E_0(P_1) = (X_1 - E_0(X_1))*(1 + (k/(1 + i))),$$

where

P_1 = equity value after earnings announcement,
$E_0(P_1)$ = equity value before earnings announcement,
X_1 = actual earnings,
$E_0(X_1)$ = earnings forecast for X_1,
k = persistence parameter representing the extent to which the current earnings surprise continues in the future (Miller and Rock [1985] assume that the persistence parameter is known to the market),

[6] The persistence parameter represents the present value of revisions in expected future earnings given one dollar of current earnings surprise.

i = market (risk-adjusted) discount rate.

Thus, in Miller and Rock [1985], the earnings announcement effect is inversely related with the discount rate.

Focusing on the link between the time-series properties of earnings, Kormendi and Lipe [1987] develop a multi-period model for the earnings announcement effect. Kormendi and Lipe's [1987] model is consistent with Miller and Rock's model in that price changes associated with earnings announcements are a function of earnings surprise, discount rate, and the persistence parameter. The multi-period model states

$$R_{jt} = (1 + \sum_{s=1}^{\infty} \beta^s Q_s) * (UX_{jt}/P_{t-1}),$$

where

R_{jt} = stock return associated earnings announcement,
β = $1/(1 + i)$,
i = risk-adjusted discount rate,
Q_s = persistent parameter representing the present value of revisions in earnings forecasted for time t+s given a dollar current earnings surprise.

In this model stock return is positively related to earnings surprise since the earnings multiplier is positive, and the earnings announcement effect is negatively correlated with the discount rate, ceteris paribus.[7]

2.4.d. Systematic Risk and Earnings Growth

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[7] Kormendi and Lipe [1987] call the terms in the first brackets, $(1 + \sum_{s=1}^{\infty} \beta^s Q_s)$, the earnings multiplier. It measures a ratio of stock price change to earnings surprise.

The theoretical models of Section 2.4.c predict an inverse relationship between the earnings announcement effect and the discount rate. Collins and Kothari [1989] examine the return/surprise relation and systematic risk using beta as a proxy for the market discount rate. Assuming that annual earnings realizations follow a random walk, change in annual earnings is used as a proxy for unexpected earnings. As a return metric, raw return (not abnormal return) is adopted following Beaver et al. [1980] and Beaver, Lambert, and Ryan [1987]. These studies report that the return/surprise relation is essentially the same whether one uses raw return or abnormal return.

Examining temporal as well as cross-sectional determinants of the return/surprise relation, Collins and Kothari [1989] propose that the return/surprise relation is also positively associated with growth opportunities. Collins and Kothari [1989] differentiate 'normal growth' from 'economic growth': 'normal growth' is commensurate with the riskiness of investments in a competitive industry whereas 'economic growth' is growth resulting from projects yielding above 'normal growth' (positive net present value projects). Since the normal growth can be more easily predicted than the economic growth, earnings surprise may be more informative of the economic growth than of the normal growth. That is, a positive (negative) earnings surprise may provide positive (negative) information about the changing spread between normal growth and economic growth. Whether an earnings surprise provides useful information about economic growth can be determined by the existence of economic growth opportunities. If a firm has economic growth opportunities and a positive earnings surprise, then the earnings surprise is more likely to be informative of economic growth. Within this framework, growth opportunities is positively associated with the return/surprise relation. As a proxy for a firm's economic growth opportunities, Collins and Kothari [1989] use the ratio of market to book value of equity based on the notion that the market to book value ratio depends on the extent to which a firm's return on its existing assets and expected future investments exceeds its required rate of return on equity. It is hypothesized that the higher the market to book value of equity ratio, the larger the share price response to an earnings surprise.

To reduce measurement error problems, Collins and Kothari [1989] employ a reverse regression (see Maddala [1977] and Klepper and Leamer [1984]). Earnings changes are regressed on returns and two terms representing equity return interactions with risk and growth:

$$UX_{it}/P_{it-1} = a_0 + a_1R_{it} + a_2R_{it}*B_{it} + a_3R_{it}*MB_{it},$$

where

UX_{it} = change in annual earnings per share,
P_{it-1} = stock price as of t-1,
R_{it} = stock return,
B_{it} = beta risk,

MB_{it} = market value to book value of equity ratio.

In a reverse regression, the functional relation between independent and dependent variables is inverted.

Since beta is negatively related to the earnings announcement effect, the coefficient a_2 is expected to be positive. Results show that the coefficient a_2 is positive and significant at the usual level (5%) of significance, which indicates a negative relationship between beta and stock price response. Risky firms have a smaller price response than firms of lower risk. Results also reveal that the coefficient a_3 is negative and significant at the usual level of significance, which indicates a positive relationship between growth and the return/surprise relation. High growth firms have a larger price response to an earnings surprise than low growth firms.

Chapter 3. A Model of Market Response to Unexpected Earnings

The voluminous literature on unexpected earnings generally concludes that the sign and magnitude of stock price changes are a positive function of the sign and magnitude of unexpected earnings. Section 1 of this chapter examines the information content of unexpected earnings within a rational expectations framework. A two-period rational expectations model describing the nature of the information content is developed in Section 2. This implements the rational expectations framework of Section 1 in an explicit two-period model of an unexpected earnings announcement. In Section 3, the two-period model is extended to a multiperiod setting.

3.1. Information Content of Unexpected Earnings

3.1.a. Rational Expectations

Rational expectations are characterized by three properties: "unbiasedness", "efficiency", and "consistency".[1] Suppose that the market forecast at time t-1 of time t earnings based on the information set L_{t-1} is related to the actual earnings realization, X_t, by

$$X_t = E_{t-1}(X_t \mid L_{t-1}) + UX_t, \tag{3.1}$$

where

[1] For a discussion of the rational expectations conditions, see Muth [1961], Sargent [1973], Shiller [1978], Lakonishok [1980], or Nakamura and Nakamura [1985].

$E_{t-1}(\cdot)$ = forecast of (.) made at time t-1,
UX_t = forecast error realized at time t.

The three properties may be stated formally as:

a) unbiasedness

$$E_{t-1}(UX_t \mid L_{t-1}) = 0 \text{ for any } t;$$

b) efficiency

$$Cov(UX_{t-1}, UX_t) = 0, \text{ where } Cov(\cdot) = \text{covariance of } (\cdot);$$

c) consistency

$$E_t(X_{t+s} \mid L_t) = E_{t+k}(X_{t+s} \mid L_{t+k}) \text{ for any } s > k \text{ if } L_t = L_{t+k}.$$

The first property, unbiasedness, implies that, on average, the market forecasts correctly; it neither systematically underestimates nor overestimates the actual future value. By the property of unbiasedness, the expected value of the forecast error is zero, on average. That is, although the forecast error in each period, UX_t, will generally be non-zero, it will be zero on average over a number of forecasts.

The second property, efficiency, requires that the market uses all relevant information available at time t-1 (the information set L_{t-1}) to form a forecast of X_t. Therefore, the forecast error, UX_t, is independent of any information in L_{t-1}. The forecast error is due to unpredictable shocks and will be unrelated to any information available at time t-1.

One way of stating the consistency property is that it is impossible to know in advance how the market will change its expectations. Only new information results in an alteration of expectations. This requires that the nature of expectations is stationary with respect to a given information set. That is, the nature of the expectational process does not change over time.

3.1.b. The Information Content of an Earnings Announcement

The classical valuation model (Gordon and Shapiro [1956]) says that stock prices are equal to the present values of expected future cash flows to equity. Under some conditions, this is equivalent to saying that the stock price equals the present value of expected future dividend payments.[2] However, Campbell and Shiller [1988] show that earnings data help to forecast future real dividends. Consequently, it can be argued that earnings should be included in the information set in forecasting stock prices.

Suppose that time t-1 is a time immediately prior to an earnings announcement for a stock and time t is the time of (or immediately after) an earnings announcement. If the market value of stock at time t is denoted as P_t, then at time t-1 the stock price assessed by the market given the information set, L_{t-1}, must be $E_{t-1}(P_t | L_{t-1})$. Following Sargent [1987], the share price response to an earnings announcement

[2] If the transversality condition holds, the present value of future cash flows is equivalent to the present value of future dividend payments. See West (1987), Mankiw, Romer, and Shapiro (1985), and Shiller (1981).

is given by

$$E_t(P_t | L_{t-1}, UX_t) - E_{t-1}(P_t | L_{t-1}) =$$
$$E_t[P_t - E_{t-1}(P_t | L_{t-1}) | UX_t - E_{t-1}(UX_t | L_{t-1})], \quad (3.2)$$

where

UX_t = unexpected earnings at time t, added to the information set, L_{t-1}, to form the new information set, L_t. (If the earnings announcement is the only information arriving between times t-1 and t, then the information set L_t consists of information available at time t-1, L_{t-1}, plus the unexpected earnings realization UX_t.)

The left hand side of Equation (3.2) is the price change due to the earnings announcement. Due to the property of unbiasedness, $E_{t-1}(UX_t | L_{t-1}) = 0$. Hence, the right hand side reduces to $E_t[P_t - E_{t-1}(P_t | L_{t-1}) | UX_t]$. As a result, the price will change as long as $P_t - E_{t-1}(P_t | L_{t-1})$ and UX_t are not orthogonal.

3.2. Share Price Response in a Two-Period Model under Uncertainty

3.2.a. Assumptions

A.1. Two-period Horizon:

Initially, assume that the firm has a two-period time horizon.

```
t=0              t=1              t=2
 I---------------I---------------I
     period 1         period 2
```

At the end of period 1, the assets of the firm are liquidated. The firm then reinvests in period 2 depending on its success in period 2. There is no risk of bankruptcy, so the firm continues to operate as a going concern throughout the two periods. The two period model is extended to a multiperiod model in a later section.

A.2. No Tax:

Following Miller and Rock [1985], there is neither corporate nor personal tax. If included, taxes would affect the magnitude but not the direction of price response to unexpected earnings. This abstraction allows a more direct analysis of the impact of investment decision revisions due to unexpected earnings on share price.

A.3. Income Function:

The firm's periodic cash flow from operations (operating income or operating earnings), X, is a stochastic, specified function of investment, I. Let

$$X_1 = E_0(G_0(I_0)) + UX_1, \tag{3.3}$$

$$X_2 = E_1(G_1(I_1)) + UX_2, \tag{3.4}$$

where

UX_t = unexpected income realized at time t,
X_t = income or earnings realized at time t,
I_t = investment to be input at time t,
$G_t(.)$ = income generating function corresponding to I_t, which is random such that $G_t(.) = v_t(G_{t-1} + K) - K$, where v_t is a positive random variable with mean 1, and K represents fixed operating costs that are assumed to be constant throughout the two periods.

The stochastic operating income generating function, G, is continuous and twice differentiable and provides diminishing positive marginal returns to investment such that $G' > 0$ and $G'' < 0$. Also $G_t(0) = -K$.

A.4. Riskless Debt:

Debt issued by the firm is assumed to be 1-period, riskless debt sold on a discount basis. Bankruptcy and agency costs are explicitly omitted from the model.

A.5. Constant Discount Rate on Operating Cash Flow:

The firm has a known, constant risk-adjusted discount rate, i, on operating income. The required return i is determined by the firm's investment opportunity set and is assumed to be known and fixed for all time.

A.6. Constant Payout Ratio Dividend Policy:

A constant proportion of expected and unexpected earnings are retained in the firm. The remainder of earnings are paid out as a dividend to shareholders. This does not require a firm's earnings to be positive. If earnings are negative, the firm can raise new equity from old shareholders through a rights offering in order to continue operating as a going concern.

3.2.b. Investment under Uncertainty

At time 0 (the beginning of period 1), the firm makes an investment decision, I_0, expecting that the marginal return on the investment will be equal to the marginal cost of capital. This is a consequence of net present value maximization. However, the firm does not know with certainty that the marginal return on capital will be equal to the marginal cost of capital. It only knows that

$$E_0(G_0'(I_0)) = 1 + i. \tag{3.5}$$

In terms of capital budgeting, the firm expects that at I_0 its investment opportunity schedule will intersect with its marginal cost of capital schedule. However, actual investment I_0 may turn out to be different from the value-maximizing level of investment.

If $G_0'(I_0) > 1 + i$ at time 1 (see Figure 1), then the firm underestimated its investment opportunity or its income function. It expected at time 0 that its marginal net return would be zero at I_0, but it realized at time 1 that the marginal net return is still positive at I_0. As a result, realized earnings exceed expected earnings. Conversely, if

$G_0'(I_0) < 1 + i$, then actual earnings are less than expected earnings (see Figure 2).

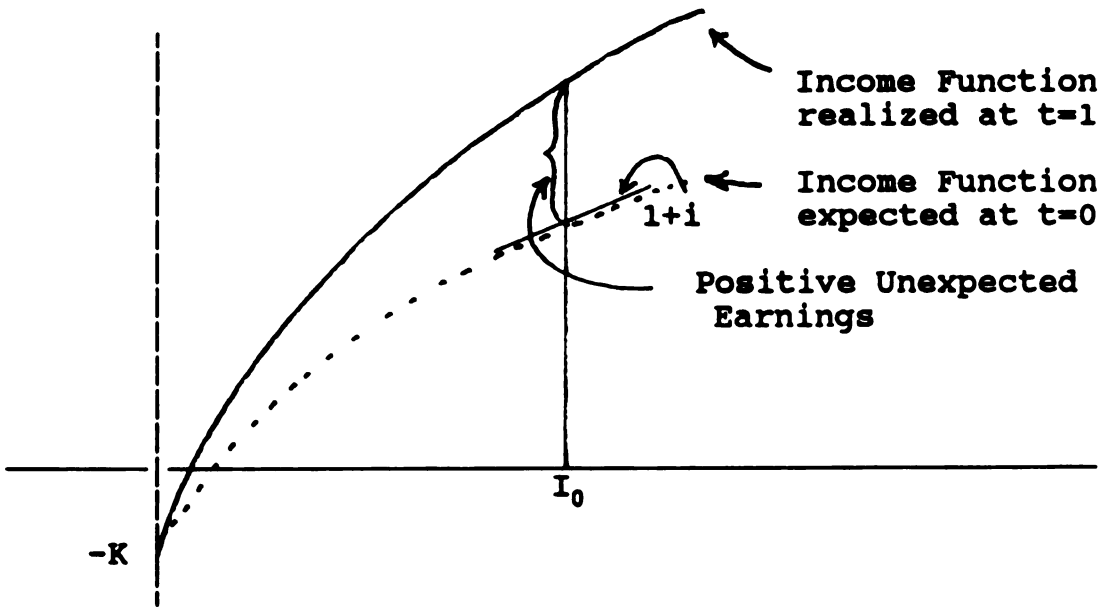

Figure 1. Positive unexpected earnings

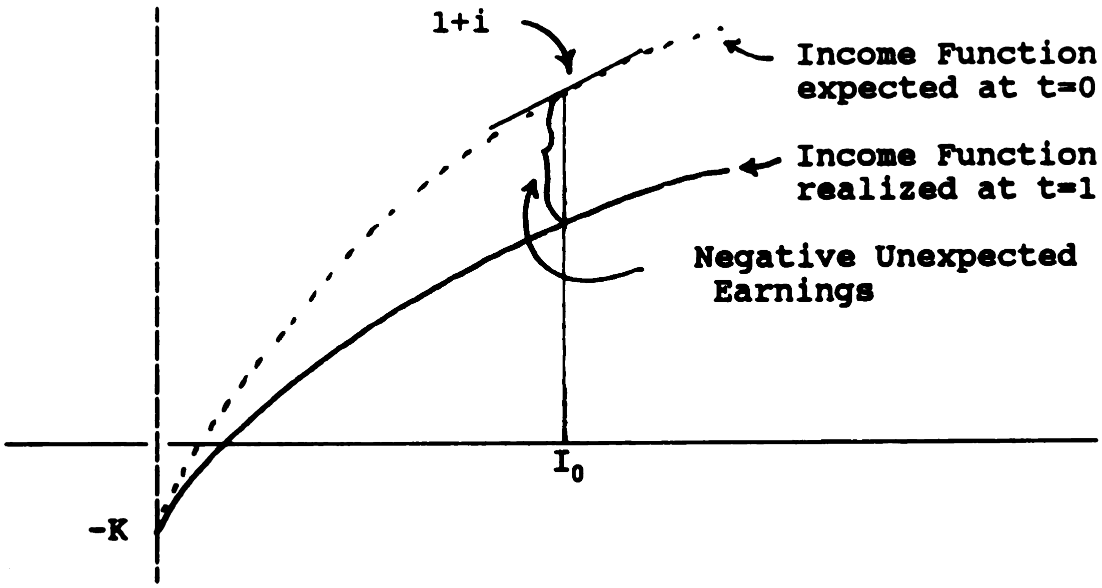

Figure 2. Negative unexpected earnings

In addition, by the property of consistency, the following should hold:

$$E_0(G_0'(I_0)) = E_0(G_1'(I_1)) = 1 + i \text{ and} \tag{3.6}$$

$$E_0(I_0) = E_0(I_1) = I_0 \tag{3.7}$$

At time 0 the cost of capital and the level of investment are expected to remain constant over the two periods. However, actual I_1 may differ from $E_0(I_1)$ based on information received in UX_1.

3.2.c. Firm Valuation

At time 1, the firm realizes X_1, pays dividend D_1, borrows capital F_1, and invests I_1, so that

$$X_1 + F_1 = D_1 + I_1. \tag{3.8}$$

The left hand side of (3.8) represents the firm's total cash inflows and the right hand side the firm's total cash outflows. The value of the original shares at time 1, V_1, is

$$V_1 = D_1 - F_1 + E_1(X_2)/(1 + i). \tag{3.9}$$

Making use of (3.4) and (3.8), Equation (3.9) may be rewritten as

$$\begin{aligned} V_1 &= X_1 - I_1 + E_1[E_1(G_1(I_1)) + UX_2]/(1 + i) \\ &= X_1 - I_1 + E_1(G_1(I_1))/(1 + i). \end{aligned} \tag{3.10}$$

Before time 1, when X_1 is not yet known, the value of the original shares is the expected value of the shares, $E_0(V_1)$:

$$E_0(V_1) = E_0(X_1) - E_0(I_1) + E_0(E_1(G_1(I_1))/(1 + i)$$
$$= E_0(X_1) - E_0(I_1) + E_0(G_1(I_1))/(1 + i). \qquad (3.11)$$

3.2.d. Association between Earnings Surprise and Stock Return

Equation (3.10) represents the value of the original shares immediately after the earnings announcement. Therefore, making use of Equation (3.3),

$$V_1 = [E_0(G_0(I_0)) + UX_1] - I_1 + E_1(G_1(I_1))/(1 + i)$$
$$= E_0(G_0(I_0)) + UX_1 - I_1 + E_1(G_1(I_1))/(1 + i). \qquad (3.12)$$

Equation (3.11) shows the value of the original shares before the earnings announcement. Using Equations (3.3) and (3.7), Equation (3.11) may be rewritten as

$$E_0(V_1) = E_0[E_0(G_0(I_0)) + UX_1] - E_0(I_1) + E_0(G_1(I_1))/(1 + i)$$
$$= E_0(G_0(I_0)) - E_0(I_1) + E_0(G_1(I_1))/(1 + i)$$
$$= E_0(G_0(I_0)) - I_0 + E_0(G_0(I_0))/(1 + i). \qquad (3.13)$$

The change in value in response to the earnings announcement is then $V_1 - E_0(V_1)$.

If $UX_1 = 0$, then $G_0'(I_0) = (1 + i)$ and the firm invested exactly the right amount of capital. Since the income generating function is a random walk, no adjustment of the investment level is necessary or desirable ($dI = 0$). The firm invested the value-maximizing amount. Consequently, equity value does not change at the time of the earnings announcement.

If UX_1 differs from 0, then the firm either under- or over-invested relative to its optimal level of investment. Equity value should either rise to reflect the unexpected investment opportunities from underinvestment ($E_1(G_1'(I_0)) > 1 + i$) or fall because income was insufficient to meet costs due to overinvestment ($E_1(G_1'(I_0)) < 1 + i$). The firm will revise its next investment I_1 so that

$$I_1 = I_0 + dI, \tag{3.14}$$

where dI represents either net new investment (dI>0) or disinvestment (dI<0) relative to the level of investment I_0 in the previous period. The value of the firm immediately after the announcement will be

$$\begin{aligned} V_1 = {} & E_0(G_0(I_0)) + UX_1 - I_0 - dI \\ & + E_1(G_1(I_0 + dI))/(1 + i). \end{aligned} \tag{3.15}$$

Since $E_1(G_1(I_0 + dI)) = E_1(G_1(I_0)) + E_1((dG_1/dI_0)*dI)$ for small changes in the level of investment,

$$\begin{aligned} V_1 = {} & E_0(G_0(I_0)) + UX_1 - I_0 - dI \\ & + E_1(G_1(I_0))/(1 + i) + E_1((dG_1/dI_0)*dI)/(1 + i), \end{aligned} \tag{3.16}$$

where $dG_t/dI_k = dG_t/dI$ at the level of investment I_k (for notational convenience let $dG_t/dI = dG_t/dI_0$). Because $E_1(G_1(I_0)) = E_0(G_0(I_0)) + UX_1$,

$$\begin{aligned} V_1 = {} & E_0(G_0(I_0)) + UX_1 - I_0 - dI + E_0(G_0(I_0))/(1 + i) \\ & + UX_1/(1 + i) + E_1((dG_1/dI)*dI)/(1 + i). \end{aligned} \tag{3.17}$$

The change in value at the time of an earnings announcement is equal to Equation (3.17) minus Equation (3.13):

$$V_1 - E_0(V_1) = UX_1 - dI + \frac{E_1((dG_1/dI)*dI)}{1 + i} + \frac{UX_1}{1 + i}. \quad (3.18)$$

Assuming $dI = a*UX_1$, where $0 < a < 1$,

$$V_1 - E_0(V_1) = UX_1 - a*UX_1 + \frac{E_1(dG_1/dI)}{1 + i}*a*UX_1 + \frac{UX_1}{1 + i}$$

$$= UX_1 * [1 - a + a*\frac{E_1(dG_1/dI)}{1 + i} + \frac{1}{1 + i}]$$

$$= UX_1 * [1 + a (\frac{E_1(dG_1/dI)}{1 + i} - 1) + \frac{1}{1 + i}]. \quad (3.19)$$

Equation (3.19) holds for both positive and negative unexpected earnings. Regardless of the sign of earnings surprise UX_1, price responds to an earnings surprise through the same mechanism. The change in value in response to an earnings surprise is proportional to the magnitude of the surprise in earnings as in the Miller and Rock model. Equation (3.19) may be rewritten as the following:

$$V_1 - E_0(V_1) = UX_1 * [1 + \frac{[a*E_1(dG_1/dI) - a*(1+i) + 1]}{1 + i}]. \quad (3.20)$$

The term, $[a*E_1(dG_1/dI) - a*(1 + i) + 1]$, corresponds to Miller and Rock's "persistence parameter". Whereas Miller and Rock provide no economic rationale behind the parameter, this model shows that the parameter is a function of marginal productivity $E_1(dG_1/dI)$, cost of capital i, and the firm's earnings retention rate a. The market responds to the earnings surprise by relating that surprise to the firm's marginal productivity, cost of capital, and earnings retention rate a. The market's reaction depends on the firm's unrealized investment opportunities whether the earnings surprise is positive or negative.

While the functional form of share price response to earnings surprises is the same for both positive and negative unexpected earnings, it is important to note that the comparative statics are different. The reason for this is twofold: 1) the association between the sign of the change in value and the sign of $[E_1(dG_1/dI)/(1+i) - 1]$, and 2) the multiplicative form of the return/surprise relationship. If

Factor	Relationship with $(V_1 - E_0(V_1))$	
	If $UX_1 > 0$	If $UX_1 < 0$
UX_1	+	+
a	+	+
$E_1(dG_1/dI)$	+	-
i	-	+

Figure 3. Predicted relationship between a factor and share price

$UX_1 > 0$, then $E_1(dG_1/dI) > (1+i)$ and the term in the brackets is positive. If $UX_1 < 0$, then $E_1(dG_1/dI) < (1+i)$ and the term in the brackets is negative. This results in an asymmetry between positive and negative earnings surprises. The relationships are summarized in Figure 3:

If $UX_1 > 0$, then $[E_1(dG_1/dI)/(1+i) - 1]$ is positive since marginal productivity must have been greater than cost of capital. Given the other factors, higher earnings retention rates a should be associated with higher equity returns. Marginal productivity should also be positively related to equity return. Cost of capital should be negatively related to return, ceteris paribus.

The comparative statics of negative earnings surprises are not as straightforward. If $UX_1 < 0$, then $[E_1(dG_1/dI)/(1+i) -1]$ is negative since marginal productivity must have been less than marginal cost. Since $V_1 - E_0(V_1)$, UX_1, and $[E_1(dG_1/dI)/(1+i) - 1]$ are all negative and $0 < a < 1$, higher earnings retention rates should be associated with higher (i.e. less negative) equity returns.[3] That is, share price should not fall as much for firms with high earnings retention rates as for firms with low retention rates, ceteris paribus. For negative earnings surprises, marginal productivity and

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[3] According to the model, equity value would increase in response to a negative surprise if $[1 + a*E_1(dG_1/dI)/(1+i) + 1/(1+i)] < 0$. This would require $a*E_1(dG_1/dI) < -2-i$, which will never occur if marginal productivity is a positive but diminishing function of investment.

cost of capital are negatively and positively related to stock return, respectively.

3.3. Multi-period Model

The basic approach of the two-period model can be extended into a multi-period setting. The multi-period model differs from the two-period model only in the time horizon. Identity (3.8) still holds:

$$X_t + F_t = I_t + D_t,$$
$$X_{t+s} + F_{t+s} = I_{t+s} + D_{t+s} \quad \text{for } s = 1, 2, \ldots T \qquad (3.21)$$
subject to $I_{t+T} = 0$ due to liquidation at time t+T.

At time t, the value of the shares outstanding at time t-1, V_t, is

$$V_t = D_t - F_t + E_t \left(\sum_{s=1}^{T} \frac{D_{t+s}}{(1+i)_s} \right)$$
$$= X_t - I_t + E_t \left(\sum_{s=1}^{T} \frac{X_{t+s} + F_{t+s} - I_{t+s}}{(1+i)_s} \right) \qquad (3.22)$$
for $T > 1$.

Hence, V_t is the value after the earnings report for X_t. On the other hand, the value just before the report, $E_{t-1}(V_t)$, is expressed as

$$E_{t-1}(V_t) = E_{t-1}(X_t) - E_{t-1}(I_t)$$
$$+ E_{t-1} \left(\sum_{s=1}^{T} \frac{X_{t+s} + F_{t+s} - I_{t+s}}{(1+i)^s} \right). \qquad (3.23)$$

Assume the firm does not change its financing policy at the time of the earnings announcement. If $G_{t-1}'(I_{t-1}) > 1 + i$, then

$$V_t - E_{t-1}(V_t) = UX_t - dI_t + E_t\left[\sum_{s=1}^{T} \frac{X_{t+s}}{(1+i)^s}\right] - E_{t-1}\left[\sum_{s=1}^{T} \frac{X_{t+s}}{(1+i)^s}\right] - E_t\left[\sum_{s=1}^{T-1} \frac{I_{t+s}}{(1+i)^s}\right] + E_{t-1}\left[\sum_{s=1}^{T-1} \frac{I_{t+s}}{(1+i)^s}\right] \quad \text{for } T > 1. \quad (3.24)$$

Due to the property of consistency, the following should hold: for s = 1, 2, ...T

$$E_{t-1}(I_t) = E_{t-1}(I_{t+s}) = I_{t-1},$$

$$E_t(I_t) = E_t(I_{t+s}) = I_t,$$

$$E_t(I_{t+s}) - E_{t-1}(I_{t+s}) = dI_t, \quad (3.25)$$

$$E_t(X_{t+s}) - E_{t-1}(X_{t+s}) = E_t((dG_t/dI_{t-1})dI_t) + UX_t. \quad (3.26)$$

Therefore, Equation (3.26) can be rewritten as

$$V_t - E_{t-1}(V_t) = UX_t - dI_t + \sum_{s=1}^{T} \frac{E_t(dG_t/dI_{t-1})dI_t + UX_t}{(1+i)^s} - \sum_{s=1}^{T-1} \frac{dI_t}{(1+i)^s} \quad \text{for } T > 1. \quad (3.27)$$

Assuming $dI_t = a*UX_t$, where $0 < a < 1$,

$$V_t - E_{t-1}(V_t) = UX_t* \left[1 - a + \sum_{s=1}^{T} \frac{E_t(dG_t/dI_{t-1})*a + 1}{(1+i)^s} - \sum_{s=1}^{T-1} \frac{a}{(1+i)^s}\right] \quad \text{for } T > 1$$

$$= UX_t^* \left[1 + a^*\left(\sum_{s=1}^{T} \frac{E_t(dG_t/dI_{t-1})}{(1+i)^s} - 1\right) - \sum_{s=1}^{T-1} \frac{1-a}{(1+i)^s} + \frac{1}{(1+i)^s}\right] \text{ for } T > 1. \quad (3.28)$$

Equation (3.28) is the multi-period model that associates unexpected earnings with share price change. By the same argument as in the two-period model, stock response to negative unexpected earnings is given by Equation (3.28). The implications of this model are the same as those of the two-period model. When T = 1, the model reduces to the two-period model. The term in the brackets is an expression corresponding to Kormendi and Lipe's [1987] earnings multiplier. It is nonnegative as in Kormendi and Lipe [1987] since variable a cannot be greater than one.

Chapter 4. Empirical Design

4.1. Empirical Specification

Although Equation (3.19) demonstrates a mechanism by which the market reacts to unexpected earnings, it requires some modification for the purpose of empirical research. First, the left-hand side should be standardized to reduce problems arising from cross-sectional differences in the level and variability of equity value. Dividing both sides by $E_0(V_1)$ and defining V_1 and UX_1 as per share values,

$$\frac{V_1 - E_0(V_1)}{E_0(V_1)} = \frac{UX_1}{E_0(V_1)} * [1 - a + a * \frac{E_1(dG_1/dI)}{1 + i} + \frac{1}{1 + i}]. \quad (4.1)$$

The left hand side of Equation (4.1) represents the percentage change in share price (stock return). UX_1 is similarly standardized as unexpected earnings as a percent of share price. Equation (4.1) has a form consistent with Christie's [1987] argument that share price is the appropriate deflator to measure the association between security returns and accounting variables. There are three other key variables in Equation (3.19). By assumption, $a = dI/UX_1$ represents the proportion of unexpected earnings which are reinvested in the firm. Retention rate (1 - payout ratio) is used as an empirical proxy for the proportion of unexpected earnings reinvested in the firm. The second empirical proxy represents the term $E_1(dG_1/dI)/(1+i)$. This term is equivalent to Tobin's q ratio. Tobin [1969] and Ciccolo [1975] show that the ratio of the marginal return on capital to the marginal cost of capital is another version of q ratio, originally defined as the ratio of the valuation of a corporation in security markets to the replacement cost of its physical assets. The third empirical proxy is the market required rate of return for the discount rate i in the model. Thus, stock price response to unexpected earnings is a function of a firm's earnings retention rate, Tobin's q ratio, and cost of capital.

For notational convenience, define

$$R = \text{Stock Return} = \frac{V_1 - E_0(V_1)}{E_0(V_1)},$$

$$S = \text{Earnings Surprise} = \frac{UX_1}{E_0(V_1)},$$

$$Q = \text{Tobin's q ratio} = \frac{E_1(dG_1/dI)}{1 + i}.$$

Equation (4.1) can be rewritten as

$$R = S * [1 + a*(Q - 1) + \frac{1}{1 + i}]. \tag{4.2}$$

Equation (4.2) shows that R is a nonlinear function of S, a, Q, and i. The concern of this study is to identify the factors associated with market response to earnings surprise, not the particular functional form, and to compare these factors with factors suggested by other studies. Therefore, a general linear model is adopted for the regression following studies such as Leftwich [1981], Jain [1982], Easton (1985], and Christie [1987]:

$$R_{jt} = \text{intercept} + b_1S_{jt} + b_2a_{jt} + b_3Q_{jt} + b_4i_{jt} + u_{jt}, \quad (4.3)$$

for firm $j = 1,.....N$ and time $t = 1,.....T$,

where u = stochastic disturbance following a white noise process.

There are three reasons why a linear model like that proposed in this chapter may not capture the true relationship between share price response and earnings announcement. First, the model could be misspecified. This could occur, for instance, if the true relationship is nonlinear or if variables are omitted from the model. This study assumes linearity in the return/surprise relationship in the hope that the true relationship is not too badly misspecified. Chapter 6 examines several variables which may have been omitted from the theoretical model in Chapter 3.

Second, the model could be correctly specified but the empirical proxies could contain measurement error. For instance, the errors-in-variables could arise in the unexpected earnings measure because of an inadequate proxy for the market's earnings expectations and/or because accounting earnings fail to reflect economic earnings. Measurement error in unexpected earnings is probably not a major problem and probably does not materially affect the results. Easton [1985] reports a strong link between security price and accounting earnings which implies that accounting earnings are a reliable proxy for economic earnings. Brown and Rozeff [1978] find the financial analysts' earnings forecasts used as market expectations in this study compare favorably to other expectational models. O'Brien [1988] further develops analysts' forecasts as a proxy for the market's expectation.

Also of concern is the measurement error in the three firm-specific variables of the model in Equation (4.3). While the earnings retention ratio is perfectly negatively related to the dividend payout ratio, the dividend payout ratio is a function of a firm's level of earnings which varies over time. Tobin's q ratio is estimated with Lindenberg and Ross' [1981] algorithm and is subject to measurement error. Beta will be used as a proxy for cost of capital. While beta is linearly related to required return under the CAPM, the impact of the discount rate in the theoretical model of Chapter 3 is nonlinear. These measurement errors may have an important impact on the empirical results. Yet the proxies represent reasonable empirical alternatives to the true variables.

Third, the relevant variables and the functional form of the return/surprise relationship could be correctly specified, but the slope coefficients may differ across firms, conditions, or over time. Chapter 5 reviews the set of conditions from the theoretical model including the size and direction of earnings surprise, dividend yield (or the earnings retention rate), q ratio, and the systematic risk of the firm. Chapter 6 extends the analysis to other conditions or factors identified in the empirical literature as contributing to share price response including firm size (Atiase [1985]), earnings predictability (Pincus [1983]), and growth (Collins and Kothari [1989]).

This study focuses on the sign and significance of the coefficient on each variable in Equation (4.3). As noted in Chapter 3, Equation (4.3) has different implications for positive and negative earnings surprises.

4.2. Empirical Proxies and the Data Sample

The earnings (income) in Equation (3.19) represents net economic earnings (see Ohlson [1983]), not merely accounting earnings. Accounting earnings are employed as a proxy for unobserved economic earnings as in other studies. Thus, the relation of earnings announcements with share prices partly depends on the correspondence of accounting earnings to economic earnings. Due to the superiority of financial analysts' forecasts over time-series models in forecasting quarterly earnings (see Chapter 2), financial analysts' consensus quarterly earnings forecasts are used.[1] The source of the consensus earnings forecasts is the I/B/E/S database of Lynch, Jones and Ryan.[2] Unexpected earnings are measured as actual earnings minus the consensus earnings forecast. Unexpected earnings are scaled by share price (derived from the CRSP daily returns tape) as of three trading days prior to the earnings announcement date as a proxy for S_{jt} in Equation (4.3). Actual earnings information is derived from accounting data on the COMPUSTAT quarterly tape.

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[1] Consensus (average) estimates of earnings are believed to play a key role in share price determination. See Elton, Gruber and Gultekin [1981 & 1984], Crichfield, Dyckman and Lakonishok [1978], and Cragg and Malkiel [1968]).

[2] Lynch, Jones and Ryan collect, on a monthly basis, earnings estimates from major brokerage firms on over 2,000 corporations. Forecast statistics include, among others, the arithmetic mean, median, range, and standard deviation of the individual analyst estimates of primary earnings per share before extraordinary items for each corporation.

Empirical research has found that unexpected earnings are associated with contemporaneous changes in price (Ball and Brown [1968]) as well as price changes which both lead (Beaver, Lambert and Morse [1980]) and lag (Collins and Kothari [1989]) earnings surprises. According to the efficient market hypothesis, however, a full response of stock prices to news occurs essentially immediately.[3] This study focuses on contemporaneous price responses and their determinants. In their study of stock price adjustment to earnings and dividend announcements, Patell and Wolfson [1984] report the effects of the announcements are captured within two days. Christie [1987] reports that if the return interval is sufficiently short, it is not necessary to consider the confounding effects of other announcements. In light of these reports, a two-day return is employed. Following Pincus [1983], the geometric average return of the day of the earnings announcement and the day preceding the announcement of firm j at time t serves as a proxy for R_{jt} in Equation (4.3). Although raw returns (not risk adjusted) are better than abnormal returns in the spirit of this study, both returns are regressed on the same set of independent variables for the sake of comparison with other studies.[4] To measure

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[3] In their study of stock price adjustment to economic news, Pearce and Roley [1985] use one-day returns to capture the effects of economic data announcements.

[4] Equation (4.1) shows that raw return should be used as a dependent variable. But if market-adjusted returns are desired, using abnormal returns should make little difference.

abnormal returns (AR_{jt}), the conventional market model is employed. That is, OLS estimates are obtained for the model:

$$R_{jt} = \alpha_j + B_j R_{mt} + e_{jt}, \qquad (4.4)$$

where

R_{jt} = return of firm j in period t,
R_{mt} = value-weighted market return obtained from the CRSP daily index tape in period t,
α_j, B_j = estimated regression coefficients of firm j,
e_{jt} = estimated error term of firm j in period t.

To obtain parameter estimates, the model is run over a 180-day estimation period.[5] Abnormal returns are then

$$AR_{jt} = R_{jt} - (\alpha_j + B_j R_{mt}). \qquad (4.5)$$

This approach is repeated for each quarter and for each firm.

Q_{jt} (Tobin's q ratio) is estimated using the algorithm[6] by

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[5] The last day of the estimation period is three days prior to the earnings announcement. A 180-day estimation period is arbitrarily chosen. A 90-day estimation period is also used resulting in basically the same measure of parameters.

[6] Lindenberg and Ross [1981] estimate
q ratio = (market value)/(replacement cost) with the following proxies:

Market value = $MVD_t + MVP_t + MVS_t$,

where MVD_t, MVP_t, and MVS_t are estimated market values of debt and preferred stock and market value of common stock, and

Replacement cost = $TA_t + RNP_t - HNP_t + RINV_t - HINV_t$,

where TA_t = total assets in year t,
RNP_t = net plant at its historical value in year t,
HNP_t = net plant at its historical value in year t,
$RINV_t$ = inventories at replacement value in year t,
$HINV_t$ = inventories at historical value in year t.

Lindenberg and Ross [1981]. The numerator of the q ratio is the firm's market value defined as the sum of the actual market value of common stock and estimated market values of preferred stock and debt. The denominator of the q-ratio is the replacement cost of the firm's assets. All the information about the numerator and the denominator are readily available from the NBER's R&D Master File.[7]

The firm's earnings retention rate (1 - payout ratio) is used as the empirical proxy for a_{jt}. Quarterly dividend payments are derived from the COMPUSTAT quarterly tape. These dividend payments should be divided by earnings to measure payout ratios. However, many firms report negative earnings resulting in negative payout ratios. To overcome this problem, dividends are divided by stock price instead of earnings, which, in fact, measures dividend yields, not dividend payout ratios. Dividend yield is a more appropriate variable for regression in the spirit of Christie [1987].

As a proxy for the required rate of return i_{jt}, market model betas are used following Collins and Kothari [1989]. According to the Capital Asset Pricing Model, beta is linearly related to required return. Equation (4.4) is adopted to

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[7] NBER's R&D Master File is created and updated at the National Bureau of Economic Research. The file consists of about 2600 large manufacturing firms. There are approximately 70 variables for each firm including market values of common stock, preferred stock, and debt, and inventories adjusted for inflation. For detail, see Hall et al. [1988].

compute betas.

The following criteria are used to select the firms in the sample. The firm must

(1) be listed on the daily returns tape constructed by the Center for Research in Security Prices (CRSP) at the University of Chicago;
(2) be listed on the COMPUSTAT quarterly tape;
(3) be listed on the I/B/E/S/ consensus tape;
(4) be listed on the NBER's R&D Master File;
(5) report quarterly earnings announcements in the Wall Street Journal Index.

Criteria (1), (2), (3), and (4) provide assurance of easy access to readily available data from the data bases. With criteria (5), earnings announcement dates can be verified. These criteria yield a sample of 4972 firm-quarters (452 firms with consecutive 11 quarters) over the period of the fourth quarter of 1983 through the second quarter of 1986. This sample period is mainly determined by the data availability on the tapes.

Using the proxies suggested in this section, Equation (4.3) is rewritten in the following form:

$$R_{jt} = \text{intercept} + b_1S_{jt} + b_2D_{jt} + b_3Q_{jt} + b_4B_{jt} + u_{jt}, \qquad (4.6)$$

$$\text{for firm } j = 1,\ldots..N \text{ and time } t = 1,\ldots..T,$$

where

D_{jt} = quarterly (contemporaneous) dividend scaled by price as of three days prior to the earnings announcement,
B_{jt} = market betas estimated on a 180-day period before the earnings announcement.

Equation (4.6) is the model to be used for empirical analysis in this study.

4.3. Model Specification and Parameterization

The sample described in the preceding section is a panel data sample of time series and cross-sectional observations. The model typically used for testing the association between stock price changes and unexpected earnings is a simple linear model. The linear model in the context of this study states

$$R_{jt} = b_0 + b_1 S_{jt} + b_2 D_{jt} + b_3 Q_{jt} + b_4 B_{jt} + u_{jt}, \tag{4.7}$$

where

R_{jt} = geometric average stock return of the day of the earnings announcement and the day preceding the announcement of firm j at time t,
S_{jt} = (actual earnings - earnings forecast)/share price of firm j at time t,
D_{jt} = dividend yield of firm j at time t,
Q_{jt} = Tobin's q-ratio of firm j at time t,
B_{jt} = market beta of firm j at time t.

The parameters are assumed to be identical across firms and over time in Equation (4.4). Temporal variation in firm-specific response to earnings announcements is not of interest in this study and is assumed to be insignificant. Instead, it is supposed that there exist important cross-sectional differences across firms. In the presence of such cross-sectional firm differences, OLS estimates according to Equation (4.4) are inefficient.

In general, there are two approaches for incorporating cross-sectional firm heterogeneity into the regression model. The fixed effects model accounts for cross-sectional effects which are not readily attributable to individual causal variables by absorbing these effects into a firm-specific intercept term. The fixed effects model states

$$R_{jt} = b_j + b_0 + b_1 S_{jt} + b_2 D_{jt} + b_3 Q_{jt} + b_4 B_{jt} + u_{jt}. \qquad (4.8)$$

Within estimation (see Mundlak [1961] or Hoch [1962]) is then applied to the model. However, in the presence of between firm variation in price response, within estimators are inefficient.

The random effects model explicitly accounts for between firm variation by treating the firm effects b_j (captured by the intercept terms in the fixed effects model) as random variables with zero mean and homoskedastic variance Var[b]. Formally,

$$R_{jt} = b_0 + b_1 S_{jt} + b_2 D_{jt} + b_3 Q_{jt} + b_4 B_{jt} + w_{jt}, \qquad (4.9)$$

where $w_{jt} = b_j + u_{jt}$.

Since the firm effects b_j are unrelated to the random error u_{jt}, the covariance matrix C is block diagonal such that

$$C = (\mathrm{Var}[b] + \mathrm{Var}[u]) * \begin{bmatrix} M & 0 & 0 & \cdots & 0 \\ 0 & M & 0 & \cdots & 0 \\ 0 & 0 & M & \cdots & 0 \\ \vdots & \vdots & \vdots & & \vdots \\ 0 & 0 & 0 & \cdots & M \end{bmatrix}_{NTxNT}, \qquad (4.10)$$

where

$$B = \begin{bmatrix} 1 & p & p & \cdots & p \\ p & 1 & p & \cdots & p \\ p & p & 1 & \cdots & p \\ \cdot & \cdot & \cdot & & \cdot \\ p & p & p & \cdots & 1 \end{bmatrix}_{TxT}, \qquad (4.11)$$

and p = Var[b]/(Var[b] + Var[u]).

The generalized least squares (GLS) estimator is consistent and efficient in this situation as long as the firm effects are not correlated with the regressors.[8]

Rewriting (4.9) in vector form,

$$Z_j = W_j\ G + w_j, \qquad j = 1,\ 2,\ \ldots\ldots\ N, \qquad (4.12)$$

where

$Z_j = (R_j)$, a Tx1 matrix,
$W_j = (e,\ F_j) = (e,\ S_j,\ D_j,\ Q_j,\ B_j)$, a Tx5 matrix,
$e' = (1,\ 1,\ \ldots\ ,\ 1)$, a 1xT unit vector,
$F_j = (S_j,\ D_j,\ Q_j,\ B_j)$, a Tx4 matrix,
$G' = (b_0,\ m') = (b_0,\ b_1,\ b_2,\ b_3,\ b_4)$, a 1x5 matrix,
$m' = (b_1,\ b_2,\ b_3,\ b_4)$, a 1x4 matrix,
$w_j' = (w_{j1},\ \ldots\ ,w_{jT})$, a 1xT matrix.

The covariance matrix of w_j (C_j) is

$$\begin{aligned} C_j &= (Var[b] + Var[u])*M \\ &= Var(u)*I_T + Var(b)*ee'. \qquad (4.13) \end{aligned}$$

Its inverse is (see Wallace and Hussain [1969] and Nerlove

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[8] For GLS estimation with the random effects model, see Balestra and Nerlove (1964), Wallace and Hussain (1969), and Maddala (1971).

[1971])

$$C_j^{-1} = \frac{1}{\mathrm{Var}(u)} \left[I_T - \frac{\mathrm{Var}(b)}{\mathrm{Var}(u) + T\,\mathrm{Var}(b)}\, ee' \right] \qquad (4.14)$$

$$= \frac{1}{\mathrm{Var}(u)} \left[\left(I_T - \frac{1}{T}\, ee' \right) + r\,\frac{1}{T}\, ee' \right]$$

$$= \frac{1}{\mathrm{Var}(u)} \left[H + r\,\frac{1}{T}\, ee' \right], \qquad (4.15)$$

where

$H = I_T - (1/T)ee'$ and
$r = \mathrm{Var}[b]/(\mathrm{Var}[u] + T\,\mathrm{Var}[b])$.

Then the normal equations for the GLS estimators can be written as

$$\left[\sum_{j=1}^{N} W_j C_j^{-1} W_j \right] \left[\begin{matrix} b_0 \\ m \end{matrix} \right]_{GLS} = \left[\sum_{j=1}^{N} W_j C_j^{-1} Z_j \right]. \qquad (4.16)$$

Solving (4.13),

$$m_{GLS} = \left[\frac{1}{T} \sum_{j=1}^{N} W_j' H W_j + r \sum_{j=1}^{N} (\bar{F}_j - \bar{F})(\bar{F}_j - \bar{F})' \right]^{-1}$$

$$* \left[\frac{1}{T} \sum_{j=1}^{N} W_j' H Z_j + r \sum_{j=1}^{N} (\bar{F}_j - \bar{F})(\bar{F}_j - \bar{F})' \right], \qquad (4.17)$$

$$b_{OGLS} = \bar{Z} - m_{GLS}'\ \bar{F}, \qquad (4.18)$$

where

$$\bar{F}_j = \frac{1}{T}\sum_{t=1}^{T} F_{jt}, \quad \bar{F} = \frac{1}{NT}\sum_{j=1}^{N}\sum_{t=1}^{T} F_{jt},$$

$$\bar{Z}_j = \frac{1}{T}\sum_{t=1}^{T} Z_{jt}, \quad \bar{Z} = \frac{1}{NT}\sum_{j=1}^{N}\sum_{t=1}^{T} Z_{jt}.$$

Using the between-group estimator (m_b) and the "within estimator" (m_w), the GLS estimator (4.14) can be rewritten as[9]

$$m_{GLS} = d*m_b + (I_4 - d)*m_w, \tag{4.19}$$

where

$$d = rT\left[\sum_{j=1}^{N} W_j'HW_j + rT\sum_{j=1}^{N}(\bar{F}_j - \bar{F})(\bar{F}_j - \bar{F})'\right]^{-1}$$

$$* \left[\sum_{j=1}^{N}(\bar{F}_j - \bar{F})(\bar{F}_j - \bar{F})'\right].$$

The GLS estimator (4.19) is a weighted average of the between-group and within estimators. In essence, r measures the weight given to the between-group variation. In OLS estimation of Equation (4.7), the between-group and within-group variations are just added up, so that the proper weight r is ignored. In the within estimation for Equation (4.8),

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[9] The within estimator is also called least-squares dummy-variable estimator. Only the variation within each group (firm in this study) is utilized in forming this estimator. On the other hand, between-group estimation ignores variation within the group. For further discussion, see Wallace and Hussain [1969], Maddala [1971], or Hausman and Taylor [1981].

the between-group variation is completely ignored. Therefore, GLS estimation of equation (4.9) gives efficient estimates. If $r \rightarrow 1$, however, m_{GLS} reduces to the OLS estimator. If $r \rightarrow 0$, m_{GLS} reduces to the within estimator.

The problem with GLS estimation is that both Var[b] and Var[u] are unknown. This study adopts a two-step GLS procedure following Taylor [1980] to overcome this problem.

4.4. Comparative Statics of the Empirical Model

Rewriting Equation (4.6),

$$R_{jt} = \text{intercept} + b_1S_{jt} + b_2D_{jt} + b_3Q_{jt} + b_4B_{jt} + u_{jt}. \qquad (4.6)$$

The predictions on b_1, b_2, b_3, and b_4 are based on Equation (3.19), but the predictions differ for $UX_1 > 0$ and $UX_1 < 0$.

Suppose actual earnings are greater than forecasted earnings (positive unexpected earnings) in Equation (3.19). Since the term in the brackets of Equation (3.19) is always greater than zero, S_{jt} is positively correlated with R_{jt}; that is, an earnings surprise (good news in this case) always leads to a positive stock return. Therefore, b_1 should be positive. While the variable a is positively related to stock return for positive surprises, dividend yield is used as a proxy for the earnings retention rate a. Hence, the coefficient on D_{jt}, b_2, is predicted to have a negative sign. The coefficients b_3 and b_4 should be positive and negative, respectively.

If actual earnings are less than forecasted earnings (negative unexpected earnings), the comparative statics of Equation (3.19) are slightly different. S_{jt} is still positively related to R_{jt}: negative earnings surprise (bad news) should result in a negative return. A negative sign is expected for b_1. Since variable a is positively related to stock return, dividend should be negatively related to stock return: the higher the dividend, the lower the return, ceteris paribus. Therefore, b_2 should be negative. The coefficients b_3 and b_4 should be negative and positive respectively.

Chapter 5. Empirical Results from the Theoretical Model

5.1 Entire Sample Results

Many authors (Brown, Richardson, and Schwager [1987], O'Brien [1988], Collins and Kothari [1989], etc.) estimate an earnings response coefficient by pooling positive and negative earnings surprises. While this is inconsistent with the theoretical model of Chapter 3, it is worthwhile investigating the factor coefficients of the theoretical model in this pooled context. This approach is intended to provide comparability to other research using pooled earnings surprises. Descriptive statistics for the entire sample including both positive and negative earnings surprises are presented in Table 1.

Summary statistics for raw and abnormal returns reveal that the average stock return associated with earnings announcement is negative. This is expected because the sample has more observations for negative earnings (2633) than positive earnings (2126) surprises. But the average return is not significantly different from zero given the standard deviation. Summary statistics for unexpected earnings show that the average earnings surprise (scaled by price) is -0.01330, and the standard deviation is 0.15102. The average earnings surprise is, therefore, not significantly different from zero. This is consistent with analysts' forecasts being, on average, unbiased estimates of actual earnings during the sample period. Dividend yield (dividend scaled by price) ranges from 0 to 0.05828. The sample mean beta of 0.93135 indicates that the sample is slightly less risky than the CRSP value weighted average. This is expected since the sample selection criteria are biased towards including larger firms and previous evidence indicates that firm size and beta are negatively related (Banz [1981]). Given the standard deviation of 0.45341, however, the average beta is not significantly lower than one. Q ratio is not significantly different from one, either.

First, stock returns (R_{jt}) are regressed on earnings surprises (S_{jt}), dividends (D_{jt}), q-ratios (Q_{jt}), and betas (B_{jt}) using OLS on the combined sample of positive and negative surprises.[1] Results are reported in Table 2 (Panel A). All the coefficients on the independent variables are significantly different from zero at the usual level of

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[1] Several studies employ reverse regression to reduce the problem in measuring earnings surprise (see, for example, Beaver, Lambert, and Ryan [1987] and Collins and Kothari [1989]). To use reverse regression the following model should be estimated:

$$S_{jt} = c_1 + c_2R_{jt} + c_3D_{jt}*R_{jt} + c_4Q_{jt}*R_{jt} + c_5B_{jt}*R_{jt}.$$

However, R_{jt}, $D_{jt}*R_{jt}$, $Q_{jt}*R_{jt}$, and $B_{jt}*R_{jt}$ are seriously correlated with one another for my sample. The highest correlation is 0.87640 between R_{jt} and $B_{jt}*R_{jt}$. Besides, c_3, c_4, or c_5 might be significantly different from zero only because of the strong relationship between S_{jt} and R_{jt}.

significance.[2] Note, however, that the model in Chapter 3 predicts that the sign of the price response relationship of q ratio and cost of capital (or beta) depends on whether the surprise is positive or negative. Coefficients on earnings surprise and dividend are as predicted by the model.

Generalized least squares (GLS) estimators are consistent and efficient and would control for heteroskedasticity problems. To obtain the GLS estimate, a two-step procedure is employed following Taylor [1980]. Within and between estimations are adopted to determine the weight r (see Chapter 4). The results are provided in Panels B and C, respectively. The mean square errors are 0.00039 and 0.00003 respectively for within and between estimates. This implies that r approaches one, so that the GLS estimate reduces to the OLS estimate. This is consistent with Christie's [1987] argument that heteroskedasticity does not appear to create serious problems in returns studies.

Beaver, Lambert and Morse [1980], Beaver, Lambert and Ryan [1987], and Collins and Kothari [1989] argue that the return/surprise relation is essentially the same whether one uses raw return or abnormal return (beta risk adjusted). Their argument is that, relative to the variability in raw

[2] A time-series model is employed to see whether the results are sensitive to the use of earnings forecast. The model suggested by Brown and Rozeff [1978] is used for earnings forecasts. No difference is found (not reported here).

return around earnings announcements, the variability in expected return based on beta risk is small such that the use of abnormal return amounts to using raw return. To verify their argument, raw return is replaced with abnormal return and the regression is repeated utilizing the same independent variables. Basically, the same results are obtained (Table 3). Nevertheless, results based on abnormal returns are also presented throughout this study for comparison because most other studies employ abnormal return as a return metric.

Overall, the results provide evidence that dividend policy, q ratio, and beta significantly impact the market response to earnings surprise. As demonstrated in Chapter 3, however, predictions on the coefficients of the independent variables should be different depending on the sign of the earnings surprise. Hence, whether the factors identified by the model are important is not clear until an analysis is made on each group of positive and negative surprise observations.

Table 1

Summary statistics: 4972 firm-quarters

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Return	4972	-0.00029	0.02094	-0.17135	0.30384
Abnormal return	4972	-0.00071	0.00020	-0.16724	0.30464
Unexpected earnings scaled by price	4972	-0.01330	0.15102	-6.02842	0.48380
Dividend scaled by price	4972	0.00672	0.00503	0.00000	0.05828
q ratio	4972	0.92127	0.60196	0.02784	7.65163
Beta	4972	0.93135	0.45341	-0.55150	2.87790

Table 2

Effect of dividend, q ratio, and beta on the market response to unexpected earnings: 4972 firm-quarters from 1983.4-1986.2*

$$R_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3Q_{jt} + b_4B_{jt} + u_{jt}{**}$$

Dependent variable: Raw return (R_{jt})

Independent Variables				Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Q ratio (Q_{jt})	Beta (B_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. OLS estimation						
0.0109#	-0.1836#	0.0014#	-0.0014#	13.916	0.0111	0.00043
0.0019	0.0613	0.0005	0.0006	(0.0001)	(0.0103)	
5.561	-2.993	2.881	-2.195			
0.0001	0.0028	0.0040	0.0282			
0.0000	0.0014	0.0020	0.0141			
B. Within estimation						
0.0107#	-0.6473#	0.0040#	-0.0039#	22.065	0.0175	0.00039
0.0020	0.1231	0.0011	0.0010	(0.0001)	(0.0167)	
5.287	-5.257	3.682	-3.789			
0.0001	0.0001	0.0002	0.0002			
0.0000	0.0000	0.0001	0.0001			
C. Between estimation						
0.0076	-0.0271	0.0009	0.0002	1.801	0.0159	0.00003
0.0050	0.0715	0.0005	0.0008	(0.1275)	(0.0071)	
1.521	-0.379	1.649	0.268			
0.1290	0.7046	0.0999	0.7891			
0.0645	0.3523	0.0499	0.3945			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 3

Effect of dividend, q ratio, and beta on the market response to unexpected earnings: OLS estimation with 4972 firm-quarters from 1983.4-1986.2*

$$AR_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3Q_{jt} + b_4B_{jt} + u_{jt}{}^{**}$$

Dependent variable: Abnormal return (AR_{jt})

Independent Variables				Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Q ratio (Q_{jt})	Beta (B_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
0.0082#	-0.1561#	0.0010#	-0.0008	8.413	0.0067	0.00040
0.0018	0.0590	0.0004	0.0006	(0.0001)	(0.0059)	
4.335	-2.646	2.033	-1.292			
0.0001	0.0082	0.0421	0.1965			
0.0000	0.0041	0.0210	0.0982			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

5.2. Separate Analyses on Positive and Negative Surprises

The theoretical model of Chapter 3 reveals an asymmetric price response to positive and negative earnings announcements. This study analyzes positive and negative earnings surprises separately. The entire sample is divided into three groups according to the signs of earnings surprises: positive (2126 observations), negative (2633 observations), and zero (213 observations) surprise groups. The zero surprise group ($S_{jt} = 0$) is of no interest in this study and is ignored. Summary statistics for positive and negative groups are reported in Tables 4 and 5, respectively. A matched-sample t-statistic comparison of means is used to examine if the firm characteristics are different for the two groups.[3] Results (see Figure 4) provide evidence that dividend and beta are not significantly different for the two groups. Q ratio, however, shows a significant difference: q ratio is significantly higher for the positive group.

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[3] The t-statistic is computed as follows:

$$t = \frac{\bar{M}_1 - \bar{M}_2}{S_p * \sqrt{(1/n_1) + (1/n_2)}},$$

where $S_p = \sqrt{((n_1-1)*S_1^2 + (n_2-1)*S_2^2)/(n_1+n_2-2)}$
M_1 = mean of a variable for the positive group,
M_2 = mean of a variable for the negative group,
S_1 = standard deviation of a variable for the positive group,
S_2 = standard deviation of a variable for the negative group,
n_1 = observations for the positive group,
n_2 = observations for the negative group,

Variable	Matched-sample t-statistic	Decision
Dividend scaled by price	-1.733	Not different
q ratio	57.528	Different
Beta	0.617	Not different

Figure 4. Comparison of positive and negative groups

Predictions on the coefficients of the regressors with positive unexpected earnings are summarized as follows:

$$R_{jt} = f(\overset{+}{S_{jt}}, \overset{-}{D_{jt}}, \overset{+}{Q_{jt}}, \overset{-}{B_{jt}}). \tag{5.1}$$

First, stock returns (R_jt) are regressed on earnings surprises alone:

$$R_{jt} = b_0 + b_1 S_{jt} + u_{jt}. \tag{5.2}$$

Results are reported in Table 6 (Panel A). As predicted, the estimate of coefficient b_1 is positive and statistically significant (at 2% level): the higher the positive earnings (good news), the higher the stock return. The same regression is repeated with abnormal return (Panel A of Table 7). Results are basically the same whether the dependent variable is raw return or abnormal return. Equation (5.2) is the base case, and as firm characteristics (D_{jt}, Q_{jt}, and/or B_{jt}) are added to this equation, partial F-statistics[4] are examined to investigate the incremental importance of each characteristic.[5]

In order to see if a variable is an important factor, the following equation is estimated:

$$R_{jt} = b_0 + b_1S_{jt} + b_2X_{jt} + u_{jt}, \qquad (5.3)$$

where X_{jt} represents one of the factors (D_{jt}, Q_{jt}, and B_{jt}). Calculation of a partial F-statistic based on Equations (5.2) and (5.3) reveals the incremental contribution of the variable X_{jt} given S_{jt}. Similarly, to see the incremental contribution of a variable Y_{jt} given S_{jt} and X_{jt}, the following equation is

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[4] The partial F-statistic is computed as follows:

$$F = \frac{(SSE_r - SSE_u) / k}{SSE_u / (n - 1 - h - k)},$$

where SSE_r = sum of squared errors for a restricted model, $y = a_0 + a_1x_1 + \ldots\ldots + a_hx_h$,
SSE_u = sum of squared errors for an unrestricted model, $y = a_0 + a_1x_1 + \ldots\ldots + a_hx_h + a_{h+1}x_{h+1} + \ldots\ldots + a_{h+k}$,
k = number of variables being tested,
h = number of variables not being tested,
n = number of observations.

[5] This procedure is similar to a stepwise regression, which is used to determine which variable to include in a model. It is, however, different from the stepwise regression in that the partial F test in this study is used only to determine the relative importance of each factor determined by the model while the stepwise regression is adopted to choose independent variables from a number of possible candidates without theoretical relationship. See Berenson, Levine, and Goldstein [1983] for stepwise regression.

employed:

$$R_{jt} = b_0 + b_1S_{jt} + b_2X_{jt} + b_3Y_{jt} + u_{jt}, \qquad (5.4)$$

where Y_{jt} represents one of the factors (D_t, Q_{jt}, or B_{jt}) differing from X_{jt}. A partial F-statistic based on Equations (5.3) and (5.4) shows if Y_{jt} is an important factor given the S_{jt} and X_{jt}. For the same purpose, the following equation is adopted:

$$R_{jt} = b_0 + b_1S_{jt} + b_2X_{jt} + b_3Y_{jt} + b_4Z_{jt} + u_{jt}, \qquad (5.5)$$

where Z_{jt} differs from either of X_{jt} and Y_{jt}. The results from estimating Equations (5.3), (5.4), and (5.5) are reported in Table 6 (Table 7 with abnormal return). Using all these results, partial F-statistics are computed to examine the incremental contribution of each factor given positive earnings surprise and/or other variables.

Figure 5 summarizes the incremental contribution of each variable given a positive earnings surprise by presenting partial F-statistics with corresponding p values and adjusted R-squares for unrestricted equations.[6] Each cell in Figure 5 contains the independent variables for an unrestricted model. The factor being tested for its incremental contribution is

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[6] Figure 5 is developed based on the results with raw returns: Table 6. Partial F-statistics and adjusted R-squares are basically the same whether raw returns or abnormal returns are used.

Equation (5.2)	Equation (5.3)	Equation (5.4)	Equation (5.5)
	S_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0100 F^* = 16.995 P = 0.0001	S_{jt}, D_{jt}, $\underline{Q}_{jt}$ Adj R^2 = 0.0105 F^* = 2.039 P = 0.1837	S_{jt}, D_{jt}, Q_{jt}, $\underline{B}_{jt}$ Adj R^2 = 0.0106 F^* = 1.102 P = 0.3130
		S_{jt}, D_{jt}, $\underline{B}_{jt}$ Adj R^2 = 0.0099 F^* = 0.605 P = 0.4566	S_{jt}, D_{jt}, B_{jt}, $\underline{Q}_{jt}$ Adj R^2 = 0.0106 F^* = 2.535 P = 0.1188
$\underline{S}_{jt}$ Adj R^2 = 0.0026 F^* = 6.510[a] P = 0.0108[b]	S_{jt}, $\underline{Q}_{jt}$ Adj R^2 = 0.0061 F^* = 6.496 P = 0.0112	S_{jt}, Q_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0105 F^* = 12.512 P = 0.0004	S_{jt}, Q_{jt}, D_{jt}, $\underline{B}_{jt}$ Adj R^2 = 0.0106 F^* = 1.102 P = 0.3130
		S_{jt}, Q_{jt}, $\underline{B}_{jt}$ Adj R^2 = 0.0048 F^* = 0.164 P = 0.7060	S_{jt}, Q_{jt}, B_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0106 F^* = 13.449 P = 0.0003
	S_{jt}, $\underline{B}_{jt}$ Adj R^2 = 0.0021 F^* = 0.054 P = 0.8337	S_{jt}, B_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0099 F^* = 17.543 P = 0.0001	S_{jt}, B_{jt}, D_{jt}, $\underline{Q}_{jt}$ Adj R^2 = 0.0106 F^* = 2.535 P = 0.1188
		S_{jt}, B_{jt}, $\underline{Q}_{jt}$ Adj R^2 = 0.0048 F^* = 6.603 P = 0.0100	S_{jt}, B_{jt}, Q_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0106 F^* = 13.449 P = 0.0003

[a] F^* = partial F-statistic
[b] P = p-value

Figure 5. Contribution of each of dividend, q ratio, and beta: Positive earnings surprises

underlined, so that a restricted model includes only the independent variables which are not underlined. Below the independent variables are an adjusted R-square for the unrestricted model, a partial F-statistic for the underlined variable, and the p-value for the F-statistic. Correlation coefficients among the variables are reported in Table 24.

Panel D of Table 6 shows that the coefficient estimates of all independent variables have the same sign as predicted. The coefficients on q ratio Q_{jt} and beta B_{jt} are not significantly different from zero. However, the coefficients on earnings surprise S_{jt} and dividends D_{jt} are statistically significant at the 2% and 1% level, respectively. This is vividly demonstrated in Figure 5, which suggests that only dividend policy has a significant impact on share price response to positive earnings surprises. Firms with higher dividend yields are likely to have a smaller response to a positive earnings surprise.

Figure 5 allows a comparison of the relative explanatory power of q ratio and dividend policy. Both variables are significant at the 2% level when included with earnings surprise alone. The two variables are correlated (See Table 10) and q ratio does not add significant explanatory power to a regression which already includes dividend. However, adding dividend to earnings surprise and q ratio adds additional explanatory power at the 1% significance level. Dividend policy dominates q ratio as a determinant of share price response to positive earnings surprises.

The result for systematic risk conflicts with the findings of Collins and Kothari [1989]. Using a reverse regression, these authors find that beta has a negative impact on the return/surprise relation and that the effect is statistically significant at the 5% level (based on a 2-tailed test). Several interpretations are possible. First, Collins and Kothari use a reverse regression which may produce spurious results. Collins and Kothari [1989] adopt the following reverse regression:

$$S_{jt} = a_0 + a_1R_{jt} + a_2R_{jt}*B_{jt} + a_3R_{jt}*MB_{jt} + u_{jt}. \qquad (5.6)$$

If the relationship between and S_{jt} and R_{jt} is strong enough to dominate an effect of beta on return/surprise relation, the coefficient a_2 can be positive (negative association between beta and return/surprise relation) and significant regardless of the effect of beta. Second, Collins and Kothari's reverse regression is run on a sample of both positive and negative earnings surprises. Third, the empirical models of this and/or Collins-Kothari and the theoretical model of Chapter 3 could be misspecified.

For negative earnings surprises, predictions on the coefficients of the regressors are the following:

$$R_{jt} = f(\overset{+}{S_{jt}}, \overset{-}{D_{jt}}, \overset{-}{Q_{jt}}, \overset{+}{B_{jt}}). \qquad (5.7)$$

Equation (5.2)	Equation (5.3)	Equation (5.4)	Equation (5.5)
$\underline{S}_{jt}$ Adj R^2 = 0.0040 F^* = 11.637[a] P = 0.0007[b]	S_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0036 F^* = 0.004 P = 0.95	S_{jt}, D_{jt}, $\underline{Q}_{jt}$ Adj R^2 = 0.0038 F^* = 1.442 P = 0.2368	S_{jt}, D_{jt}, Q_{jt}, $\underline{B}_{jt}$ Adj R^2 = 0.0046 F^* = 3.099 P = 0.0827
		S_{jt}, D_{jt}, $\underline{B}_{jt}$ Adj R^2 = 0.0042 F^* = 4.523 P = 0.0355	S_{jt}, D_{jt}, B_{jt}, $\underline{Q}_{jt}$ Adj R^2 = 0.0046 F^* = 2.144 P = 0.1610
	S_{jt}, $\underline{Q}_{jt}$ Adj R^2 = 0.0042 F^* = 1.400 P = 0.2413	S_{jt}, Q_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0038 F^* = 0.042 P = 0.0004	S_{jt}, Q_{jt}, D_{jt}, $\underline{B}_{jt}$ Adj R^2 = 0.0046 F^* = 3.099 P = 0.0827
		S_{jt}, Q_{jt}, $\underline{B}_{jt}$ Adj R^2 = 0.0050 F^* = 3.079 P = 0.0719	S_{jt}, Q_{jt}, B_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0046 F^* = 0.021 P = 0.8912
	S_{jt}, $\underline{B}_{jt}$ Adj R^2 = 0.0045 F^* = 2.250 P = 0.1496	S_{jt}, B_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0042 F^* = 0.148 P = 0.7170	S_{jt}, B_{jt}, D_{jt}, $\underline{Q}_{jt}$ Adj R^2 = 0.0046 F^* = 2.144 P = 0.1610
		S_{jt}, B_{jt}, $\underline{Q}_{jt}$ Adj R^2 = 0.0050 F^* = 2.272 P = 0.1472	S_{jt}, B_{jt}, Q_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0046 F^* = 0.021 P = 0.8912

[a] F^* = partial F-statistic
[b] P = p-value

Figure 6. Contribution of each of dividend, q ratio, and beta: Negative earnings surprises

The coefficient estimates are reported in Tables 8 and 9. Figure 6 summarizes the empirical findings in a format like that of Figure 5. Figure 6 demonstrates that no variable has a significant coefficient except earnings surprise. The coefficient of beta is relatively significant (at 8% in Panel D of Table 8).[7] But the relation is opposite that predicted, which may be consistent with Jain [1982].[8] For q ratio, the coefficient estimate is insignificant with a positive sign. Only the dividend has the predicted sign. Correlation coefficients among the variables are reported in Table 11.

Interestingly, the coefficient on positive earnings surprise (0.0387 in Panel D of Table 6) is significantly different from that on negative earnings surprise (0.0065 in Panel D of Table 8).[9] A comparison of other panels in Tables 6 and 8 leads to the same conclusion. This implies that the

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[7] Figure 6 is built based on the results with raw returns: Table 7. Partial F-statistics and adjusted R-squares are basically the same whether raw returns or abnormal returns are used.

[8] Jain [1982] empirically finds that given a positive (negative) abnormal return, the higher the variance of a stock return, the higher (lower) the return. If beta is positively related to variance of stock return, it is predicted that the higher the beta, the lower the stock return with negative unexpected earnings. However, it is not determined whether the negative coefficient supports Jain [1982] since it is significant merely at 8%.

[9] A two-sample t-statistic is used to investigate whether the coefficient on positive earnings surprise is significantly different from that on negative earnings surprise (see footnote 4). The t-statistic is equal to 107.812.

equity market response to earnings announcements is asymmetric. The results indicate that the equity market, on average, responds more strongly to positive earnings surprises than to negative earnings surprises.

To summarize, the model developed in Chapter 3 is supported by the positive earnings surprise group but is not supported by the negative surprise group. The results provide some evidence that dividend policy is an important factor to be considered in return/surprise studies. However, whether dividend impacts the relation between earnings surprise and stock return should be determined after additional analyses. Dividend may be a proxy for factors suggested by other studies such as firm size, growth, or earnings predictability. Importantly, the separate analyses provide evidence of asymmetric market response to unexpected earnings: positive earnings surprises yield more response than negative earnings surprises.

Table 4

Descriptive statistics: Positive earnings surprises (2126 firm-quarters)

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Return	2126	0.00454	0.01914	-0.10039	0.10351
Abnormal return	2126	0.00368	0.01824	-0.10536	0.09527
Unexpected earnings scaled by price	2126	0.00964	0.02642	0.00001	0.48380
Dividend scaled by price	2126	0.00661	0.00507	0.00000	0.05828
q ratio	2126	0.95692	0.65056	0.03598	7.65163
Beta	2126	0.92337	0.44839	-0.29091	2.83044

Table 5

Descriptive statistics: Negative earnings surprises
(2633 firm-quarters)

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Return	2633	-0.00430	0.02175	-0.17135	0.30384
Abnormal return	2633	-0.00438	0.02080	-0.16724	0.30464
Unexpected earnings scaled by price	2633	-0.03290	0.20417	-6.02842	-0.00001
Dividend scaled by price	2633	0.00687	0.00505	0.00000	0.03232
q ratio	2633	0.86660	0.54931	0.02784	6.58644
Beta	2633	0.92842	0.45681	-0.55150	2.87790

Table 6

Market response to positive unexpected earnings:
2126 firm-quarters from 1983.4-1986.2*
(Dependent variable: Raw return (R_{jt}))

Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Q ratio (Q_{jt})	Beta (B_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
Independent Variables				Regression Statistics		
A. $R_{jt} = b_0 + b_1S_{jt} + u_{jt}$**						
0.0387#				6.510	0.0031	0.00036
0.0160				(0.0108)	(0.0026)	
2.411						
0.0160						
0.0080						
B. $R_{jt} = b_0 + b_1S_{jt} + b_2X_{jt} + u_{jt}$**, X belonging to {D, Q, B}						
0.0338#	-0.3369#			11.768	0.0110	0.00036
0.0157	0.0817			(0.0001)	(0.0100)	
2.151	-4.120					
0.0316	0.0001					
0.0108	0.0000					
0.0472#		0.0016#		6.502	0.0061	0.00036
0.0159		0.0006		(0.0015)	(0.0052)	
2.964		2.545				
0.0031		0.0110				
0.0015		0.0055				
0.0400#			0.0001	3.276	0.0031	0.00036
0.0157			0.0009	(0.0380)	(0.0021)	
2.553			0.213			
0.0108			0.8312			
0.0054			0.4156			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 6 (cont'd.)

Independent Variables				Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Q ratio (Q_{jt})	Beta (B_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
C. $R_{jt} = b_0 + b_1S_{jt} + b_2X_{jt} + b_3Y_{jt} + u_{jt}$**, X and Y belonging to {D, Q, B}						
0.0386#	-0.3019#	0.0009		8.530	0.0119	0.00036
0.0160	0.0853	0.0006		(0.0001)	(0.0105)	
2.404	-3.538	1.429				
0.0163	0.0004	0.1532				
0.0081	0.0002	0.0766				
0.0334#	-0.3525#		-0.0007	8.047	0.0112	0.00036
0.0157	0.0841		0.0009	(0.0001)	(0.0099)	
2.125	-4.188		-0.781			
0.0337	0.0001		0.4351			
0.0168	0.0000		0.2175			
0.0474#		0.0017#	-0.0003	4.386	0.0062	0.00036
0.0159		0.0006	0.0009	(0.0046)	(0.0048)	
2.976		2.567	-0.398			
0.0030		0.0103	0.6907			
0.0015		0.0051	0.3453			
D. $R_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3Q_{jt} + b_4B_{jt} + u_{jt}$**						
0.0387#	-0.3185#	0.0010	-0.0010	6.677	0.0124	0.00036
0.0160	0.0867	0.0006	0.0009	(0.0001)	(0.0106)	
2.411	-3.670	1.596	-1.056			
0.0160	0.0002	0.1106	0.2910			
0.0080	0.0001	0.0553	0.1455			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 7

Market response to positive unexpected earnings: 2126 firm-quarters from 1983.4-1986.2*
(Dependent variable: Abnormal return (AR_{jt}))

Independent Variables				Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Q ratio (Q_{jt})	Beta (B_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $AR_{jt} = b_0 + b_1S_{jt} + u_{jt}$**						
0.0421#				7.960	0.0037	0.00033
0.0149				(0.0048)	(0.0033)	
2.821						
0.0048						
0.0024						
B. $AR_{jt} = b_0 + b_1S_{jt} + b_2X_{jt} + u_{jt}$**, X belonging to {D, Q, B}						
0.0368#	-0.2866#			10.766	0.0100	0.00032
0.0149	0.0779			(0.0001)	(0.0091)	
2.461	-3.678					
0.0139	0.0002					
0.0069	0.0001					
0.0475#		0.0012#		5.996	0.0056	0.00033
0.0151		0.0006		(0.0025)	(0.0047)	
3.133		2.005				
0.0018		0.0451				
0.0009		0.0225				
0.0422#			0.0002	4.018	0.0038	0.00033
0.0149			0.0008	(0.0181)	(0.0028)	
2.823			0.281			
0.0048			0.7785			
0.0024			0.3892			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 7 (cont'd.)

Independent Variables				Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Q ratio (Q_{jt})	Beta (B_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
C. $AR_{jt} = b_0 + b_1S_{jt} + b_2X_{jt} + b_3Y_{jt} + u_{jt}$**, X and Y belonging to {D, Q, B}						
0.0400#	-0.2633#	0.0006		7.508	0.0105	0.00032
0.0153	0.0813	0.0006		(0.0001)	(0.0091)	
2.616	-3.237	0.996				
0.0090	0.0012	0.3194				
0.0045	0.0006	0.1597				
0.0365#	-0.2980#		-0.0005	7.296	0.0102	0.00032
0.0149	0.0802		0.0009	(0.0001)	(0.0088)	
2.440	-3.715		-0.603			
0.0148	0.0002		0.5467			
0.0074	0.0001		0.2733			
0.0476#		0.0012#	-0.0001	4.009	0.0056	0.00033
0.0151		0.0006	0.0009	(0.0076)	(0.0042)	
3.138		1.995	-0.197			
0.0017		0.0462	0.8439			
0.0008		0.0231	0.4219			
D. $AR_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3Q_{jt} + b_4B_{jt} + u_{jt}$**						
0.0401#	-0.2752#	0.0007	-0.0007	5.788	0.0108	0.00032
0.0153	0.0827	0.0006	0.0009	(0.0001)	(0.0089)	
2.621	-3.327	1.123	-0.796			
0.0088	0.0009	0.2615	0.4262			
0.0044	0.0004	0.1307	0.2131			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 8

Market response to negative unexpected earnings: 2633 firm-quarters from 1983.4-1986.2*
(Dependent variable: Raw return (R_{jt}))

Independent Variables				Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Q ratio (Q_{jt})	Beta (B_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $R_{jt} = b_0 + b_1S_{jt} + u_{jt}$**						
0.0070#				11.637	0.0044	0.00047
0.0020				(0.0007)	(0.0040)	
3.411						
0.0007						
0.0080						
B. $R_{jt} = b_0 + b_1S_{jt} + b_2X_{jt} + u_{jt}$**, X belonging to {D, Q, B}						
0.0070#	-0.0058			5.819	0.0044	0.00047
0.0020	0.0839			(0.0030)	(0.0036)	
3.405	-0.069					
0.0007	0.9447					
0.0003	0.4723					
0.0067#		0.0009		6.527	0.0049	0.00047
0.0020		0.0007		(0.0015)	(0.0042)	
3.235		1.190				
0.0012		0.2343				
0.0006		0.1271				
0.0069#			-0.0013	6.950	0.0053	0.00047
0.0020			0.0009	(0.0010)	(0.0045)	
3.334			-1.502			
0.0009			0.1331			
0.0004			0.0665			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 8 (cont'd)

Independent Variables				Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Q ratio (Q_{jt})	Beta (B_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
C. $R_{jt} = b_0 + b_1S_{jt} + b_2X_{jt} + b_3Y_{jt} + u_{jt}$**, X and Y belonging to {D, Q, B}						
0.0067#	0.0138	0.0009		4.359	0.0049	0.00047
0.0021	0.0855	0.0007		(0.0047)	(0.0038)	
3.200	0.162	1.198				
0.0014	0.8710	0.2308				
0.0007	0.4355	0.1154				
0.0069#	-0.0323		-0.0014	4.679	0.0053	0.00047
0.0020	0.0856		0.0009	(0.0031)	(0.0042)	
3.352	-0.378		-1.547			
0.0008	0.7053		0.1219			
0.0004	0.3526		0.0609			
0.0064#		0.0011	-0.0016	5.392	0.0061	0.00047
0.0020		0.0007	0.0009	(0.0012)	(0.0050)	
3.096		1.507	-1.764			
0.0020		0.1320	0.0779			
0.0010		0.0660	0.0389			
D. $R_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3Q_{jt} + b_4B_{jt} + u_{jt}$**						
0.0065#	-0.0120	0.0011	-0.0016	4.047	0.0061	0.00047
0.0021	0.0867	0.0008	0.0009	(0.0028)	(0.0046)	
3.095	-0.139	1.465	-1.762			
0.0020	0.8894	0.1431	0.0782			
0.0010	0.4447	0.0715	0.0396			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 9

Market response to negative unexpected earnings: 2633 firm-quarters from 1983.4-1986.2*
(Dependent variable: Abnormal return (AR_{jt}))

Independent Variables				Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Q ratio (Q_{jt})	Beta (B_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $AR_{jt} = b_0 + b_1S_{jt} + u_{jt}$**						
0.0043#				4.723	0.0018	0.00044
0.0020				(0.0298)	(0.0014)	
2.173						
0.0298						
0.0149						
B. $AR_{jt} = b_0 + b_1S_{jt} + b_2X_{jt} + u_{jt}$**, X belonging to {D, Q, B}						
0.0043#	-0.0030			2.361	0.0018	0.00044
0.0020	0.0815			(0.0945)	(0.0010)	
2.169	-0.037					
0.0302	0.9702					
0.0151	0.4856					
0.0041#		0.0005		2.635	0.0020	0.00044
0.0020		0.0007		(0.0719)	(0.0012)	
2.063		0.739				
0.0392		0.4597				
0.0196		0.2298				
0.0043#			-0.0005	2.577	0.0020	0.00044
0.0020			0.0009	(0.0762)	(0.0012)	
2.138			-0.657			
0.0326			0.5113			
0.0168			0.2556			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.
** The coefficient estimate on intercept (b_0) is not reported.
\# Significant at 5% level based on 2-tailed tests.

Table 9 (cont'd)

Independent Variables				Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Q ratio (Q_{jt})	Beta (B_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
C. $AR_{jt} = b_0 + b_1S_{jt} + b_2X_{jt} + b_3Y_{jt} + u_{jt}$**, X and Y belonging to {D, Q, B}						
0.0041#	0.0088	0.0005		1.760	0.0020	0.00044
0.0020	0.0830	0.0007		(0.1509)	(0.0009)	
2.040	0.107	0.746				
0.0414	0.9150	0.4557				
0.0207	0.4575	0.2278				
0.0043#	-0.0143		-0.0006	1.727	0.0020	0.00044
0.0020	0.0832		0.0009	(0.1574)	(0.0008)	
2.144	-0.173		-0.678			
0.0321	0.8630		0.4978			
0.0160	0.4315		0.2489			
0.0040#		0.0006	-0.0007	1.977	0.0023	0.00044
0.0020		0.0007	0.0009	(0.1136)	(0.0011)	
1.996		0.882	-0.814			
0.0460		0.3779	0.4158			
0.0230		0.1889	0.2079			
D. $AR_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3Q_{jt} + b_4B_{jt} + u_{jt}$**						
0.0040#	-0.0026	0.0006	-0.0007	1.482	0.0023	0.00044
0.0020	0.0843	0.0007	0.0009	(0.2048)	(0.0007)	
1.990	-0.032	0.865	-0.807			
0.0466	0.9745	0.3870	0.4195			
0.0233	0.4872	0.1935	0.2097			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 10

Pearson correlation coefficients:
2126 firm-quarters from 1983.4-1986.2
with positive earnings surprises

	Raw return (R_{jt})	Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	q ratio (Q_{jt})	Beta (B_{jt})
Raw return (R_{jt})	1.00000 (0.0000)	0.05528 (0.0108)	-0.09386 (0.0001)	0.04443 (0.0405)	0.00414 (0.8486)
Earnings surprise scaled by price (S_{jt})	0.05528 (0.0108)	1.00000 (0.0000)	-0.09656 (0.0001)	-0.17682 (0.0001)	-0.00864 (0.6905)
Dividend scaled by price (D_{jt})	-0.09386 (0.0001)	-0.09656 (0.0001)	1.00000 (0.0000)	-0.26419 (0.0001)	-0.23412 (0.0001)
q ratio (Q_{jt})	0.04443 (0.0405)	-0.17682 (0.0001)	-0.26419 (0.0001)	1.00000 (0.0000)	0.23367 (0.0001)
Beta (B_{jt})	0.00414 (0.8486)	-0.00864 (0.6905)	-0.23412 (0.0001)	0.23367 (0.0001)	1.0000 (0.0000)

Table 11

Pearson correlation coefficients:
2633 firm-quarters from 1983.4-1986.2
with negative earnings surprises

	Raw return (R_{jt})	Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	q ratio (Q_{jt})	Beta (B_{jt})
Raw return (R_{jt})	1.00000 (0.0000)	0.06636 (0.0007)	0.00390 (0.8416)	0.03130 (0.1083)	-0.03246 (0.0959)
Earnings surprise scaled by price (S_{jt})	0.06636 (0.0007)	1.00000 (0.0000)	0.07899 (0.0001)	0.12576 (0.0001)	-0.04939 (0.0113)
Dividend scaled by price (D_{jt})	0.00390 (0.8416)	0.07899 (0.0001)	1.00000 (0.0000)	-0.18025 (0.0001)	-0.20354 (0.0001)
q ratio (Q_{jt})	0.03130 (0.1083)	0.12576 (0.0001)	-0.18025 (0.0001)	1.00000 (0.0000)	0.18401 (0.0001)
Beta (B_{jt})	-0.03246 (0.0959)	-0.04939 (0.0113)	-0.20354 (0.0001)	0.18401 (0.0001)	1.0000 (0.0000)

Chapter 6. An Extension to Other Factors

6.1. Dividends versus Firm Size

The differential information hypothesis (Freeman [1987]) suggests that differential information affects stock returns at the time of an earnings announcement. Atiase [1985] and Freeman [1987] argue that firm size is a good proxy for differential information such that the absolute value of stock price change is negatively related to firm size. In the context of this study, stock return should be negatively related to firm size given the positive unexpected earnings as well as positively related given the negative unexpected earnings.

To investigate whether the effect of firm size is supported on the basis of the sample, stock return is regressed on positive earnings surprise and firm size. The coefficient estimate on firm size is predicted negative. As a proxy for firm size, market value of common stock is used. Following Atiase [1985] and Collins and Kothari [1989], natural logarithm is adopted so that larger market values are stated as percentage increase. The following equation is estimated:

$$R_{jt} = b_0 + b_1S_{jt} + b_2F_{jt} + u_{jt}, \qquad (6.1)$$

where F_{jt} is the natural logarithm of the market value of common stock. Regression results are found in Panel A of Table 12 (Table 13 with abnormal return). As expected, the coefficient estimate on firm size is negative. On the basis of the sample, the information hypothesis is confirmed for positive earnings surprises.

On average, large firms maintain higher payout ratios than small firms. A dividend effect could be found merely because dividend is positively related to firm size. In other words, dividend may be a proxy for firm size. Therefore, the analysis should be controlled for firm size to see whether the dividend effect found in Chapter 5 essentially reflects differential information or a firm size effect. One effective way to control for firm size is to include dividend and firm size simultaneously in a regression (see Jain [1982]). The following equation is adopted for this purpose:

$$R_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3F_{jt} + u_{jt}. \qquad (6.2)$$

The results are reported in Panel B of Table 12 (Table 13 with abnormal return). The coefficient of dividend is still negative and significant. On the contrary, the coefficient on firm size is no longer significant although it has the same sign as predicted. Comparing Panels A and B of Table 12 results in the conclusion for positive surprises that, given dividend, firm size is not an important explanatory factor. That is, the effect of firm size on the return/surprise relation is dominated by the dividend effect. Figure 7

Equation (5.2)	Equation (5.3)	Equation (5.4)
S_{jt} Adj R^2 = 0.0026 F^* = 6.510[a] P = 0.0108[b]	S_{jt}, D_{jt} Adj R^2 = 0.0100 F^* = 16.971 P = 0.0001	S_{jt}, D_{jt}, E_{jt} Adj R^2 = 0.0101 F^* = 1.074 P = 0.3210
	S_{jt}, E_{jt} Adj R^2 = 0.0046 F^* = 5.307 P = 0.0223	S_{jt}, F_{jt}, D_{jt} Adj R^2 = 0.0101 F^* = 12.726 P = 0.004

[a] F^* = partial F-statistic
[b] P = p-value

Figure 7. Contribution of each of dividend and firm size: Positive earnings surprises

summarizes the incremental explanatory power of dividend and firm size.

The same procedure is repeated with the negative earnings surprise group. Results in Tables 14 and 15 (Panel A) support the differential information hypothesis. The coefficient on firm size is positive and significant as expected. The results of estimating Equation (6.2) reported in Tables 14 and 15 (Panel B) also show that the coefficient on firm size is highly significant even after including dividend in the regression. This is summarized in Figure 8.

As an additional analysis, this study investigates

Equation (5.2)	Equation (5.3)	Equation (5.4)
S_{jt} Adj R^2 = 0.0040 F^* = 11.637[a] P = 0.0007[b]	S_{jt}, D_{jt} Adj R^2 = 0.0036 F^* = 5.819 P = 0.0030	S_{jt}, D_{jt}, E_{jt} Adj R^2 = 0.0091 F^* = 15.355 P = 0.0001
	S_{jt}, E_{jt} Adj R^2 = 0.0046 F^* = 13.366 P = 0.0003	S_{jt}, F_{jt}, D_{jt} Adj R^2 = 0.0091 F^* = 1.983 P = 0.1583

[a] F^* = partial F-statistic
[b] P = p-value

Figure 8. Contribution of each of dividend and firm size: Negative earnings surprises

whether the effect of firm size found in this section is in fact a differential information effect. One way of controlling for differential information is to examine those firms with a minimal set of public information available. Assuming that the Wall Street Journal is the source of public information,[1] firms for which the Wall Street Journal publishes other information than earnings and dividend

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[1] Several studies such as Grant [1980] use the Wall Street Journal to investigate differential information about firms based on the implicit assumption that the Wall Street Journal is the public information source.

announcements are eliminated.[2] In so doing, firms in the reduced sample should have an identical information environment. This procedure causes a reduction in sample size from 2126 to 830 observations for the positive group and from 2633 to 1001 observations for the negative group. This procedure does not affect the variation in firm size which ranges from about $9 million to $5 billion. Only the information environment is controlled. Descriptive statistics for each reduced sample are presented in Table 16 (positive group) and Table 17 (negative group).

First, stock return is regressed on earnings surprise and firm size using Equation (6.1). Secondly, Equation (6.2) is estimated based on the reduced sample. Panel A of Table 18 (Table 19 with abnormal return) reveals that firm size is no longer important given the positive unexpected earnings when the information environment is controlled. Panel A of Table 20 (Table 21 with abnormal return) also shows that firm size is not an important factor given negative unexpected earnings when the information environment is controlled. This supports the differential information hypothesis. However, the coefficient on dividend is not affected by the information control. The dividend effect with positive earnings surprise is still significant after the information control. These

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[2] The reason is that earnings and dividend announcements are the minimum amount of information published in the Wall Street Journal Index.

results are presented in Tables 18 through 21 (Panel B). Figures 9 and 10 are produced based on these results.

Equation (5.2)	Equation (5.3)	Equation (5.4)
$\underline{S}_{jt}$ Adj R^2 = 0.0338 F^* = 28.969[a] P = 0.0001[b]	S_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0391 F^* = 6.549 P = 0.0106	S_{jt}, D_{jt}, $\underline{E}_{jt}$ Adj R^2 = 0.0387 F^* = 0.657 P = 0.4181
	S_{jt}, $\underline{E}_{jt}$ Adj R^2 = 0.0317 F^* = 0.217 P = 0.6362	S_{jt}, F_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0387 F^* = 6.862 P = 0.0083

[a] F^* = partial F-statistic
[b] P = p-value

Figure 9. Contribution of each of dividend and firm size: Positive earnings surprises (based on the reduced sample)

Equation (5.2)	Equation (5.3)	Equation (5.4)
$\underline{S}_{jt}$ Adj R^2 = 0.0080 F^* = 9.014[a] P = 0.0027[b]	S_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0076 F^* = 0.655 P = 0.4190	S_{jt}, D_{jt}, $\underline{E}_{jt}$ Adj R^2 = 0.0078 F^* = 1.196 P = 0.2712
	S_{jt}, $\underline{E}_{jt}$ Adj R^2 = 0.0077 F^* = 0.713 P = 0.3997	S_{jt}, F_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0078 F^* = 1.138 P = 0.2826

[a] F^* = partial F-statistic
[b] P = p-value

Figure 10. Contribution of each of dividend and firm size: Negative earnings surprises (based on the reduced sample)

Table 12

Effect of dividend and firm size on the market response to positive unexpected earnings: 2126 firm-quarters from 1983.4-1986.2* (Dependent variable: Raw return (R_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Natural logarithm of firm size (F_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $R_{jt} = b_0 + b_1S_{jt} + b_2F_{jt} + u_{jt}$**					
0.0316#		-0.0006#	5.918	0.0055	0.00036
0.0161		0.0002	(0.0027)	(0.0046)	
1.964		-2.305			
0.0496		0.0213			
0.0248		0.0106			
B. $R_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3F_{jt} + u_{jt}$**					
0.0303	-0.3080#	-0.0002	8.209	0.0115	0.00036
0.0160	0.0863	0.0002	(0.0001)	(0.0101)	
1.888	-3.567	-1.044			
0.0592	0.0004	0.2967			
0.0296	0.0002	0.1488			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 13

Effect of dividend and firm size on the market response to positive unexpected earnings: 2126 firm-quarters from 1983.4-1986.2*
(Dependent variable: Abnormal return (AR_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Natural logarithm of firm size (F_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $AR_{jt} = b_0 + b_1S_{jt} + b_2F_{jt} + u_{jt}$**					
0.0322#		-0.0007#	8.085	0.0076	0.00033
0.0153		0.0002	(0.0003)	(0.0066)	
2.103		-2.861			
0.0355		0.0043			
0.0177		0.0021			
B. $AR_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3F_{jt} + u_{jt}$**					
0.0312#	-0.2396#	-0.0004	8.239	0.0115	0.00032
0.0153	0.0822	0.0002	(0.0001)	(0.0101)	
2.040	-2.914	-1.778			
0.0415	0.0036	0.0755			
0.0207	0.0018	0.0377			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 14

Effect of dividend and firm size on the market response to negative unexpected earnings: 2633 firm-quarters from 1983.4-1986.2*
(Dependent variable: Raw return (R_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Natural logarithm of firm size (F_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $R_{jt} = b_0 + b_1S_{jt} + b_2F_{jt} + u_{jt}$**					
0.0060#		0.0009#	12.527	0.0094	0.00046
0.0028		0.0002	(0.0001)	(0.0087)	
2.893		3.656			
0.0038		0.0003			
0.0019		0.0001			
B. $R_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3F_{jt} + u_{jt}$**					
0.0061	-0.1257	0.0011#	9.019	0.0102	0.00046
0.0020	0.0891	0.0002	(0.0001)	(0.0091)	
2.940	-1.411	3.919			
0.0033	0.1583	0.0001			
0.0016	0.0791	0.0000			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 15

Effect of dividend and firm size on the market response to negative unexpected earnings: 2633 firm-quarters from 1983.4-1986.2*
(Dependent variable: Abnormal return (AR_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Natural logarithm of firm size (F_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $AR_{jt} = b_0 + b_1S_{jt} + b_2F_{jt} + u_{jt}$**					
0.0035		0.0008#	7.414	0.0056	0.00044
0.0020		0.0002	(0.0006)	(0.0049)	
1.727		3.176			
0.0843		0.0015			
0.0421		0.0007			
B. $AR_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3F_{jt} + u_{jt}$**					
0.0035#	-0.1041	0.0009#	5.425	0.0062	0.00044
0.0020	0.0866	0.0002	(0.0012)	(0.0050)	
1.767	-1.202	3.396			
0.0774	0.2295	0.0755			
0.0387	0.1147	0.0007			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 16

Summary statistics: 830 firm-quarters
(All unexpected earnings are positive.)

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Return	830	0.00639	0.02067	-0.10039	0.08526
Abnormal return	830	0.00541	0.02004	-0.10536	0.08588
Unexpected earnings scaled by price	830	0.00822	0.01945	0.00001	0.32320
Dividend scaled by price	830	0.00540	0.00423	0.00000	0.02691
Firm size*	830	181.31394	508.79328	10.54762	4535.99617

* Market value of common stock (in million)

Table 17

Summary statistics: 1001 firm-quarters
(All unexpected earnings are negative.)

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Return	1001	-0.00489	0.02285	-0.12790	0.30384
Abnormal return	1001	-0.00503	0.02258	-0.12436	0.30464
Unexpected earnings scaled by price	1001	-0.02073	0.13429	-3.67145	-0.00004
Dividend scaled by price	1001	0.00607	0.00478	0.00000	0.03232
Firm size*	1001	165.62563	463.81707	9.93218	3958.45866

* Market value of common stock (in million)

Table 18

Effect of dividend and firm size on the market response to positive unexpected earnings: 830 firm-quarters from 1983.4-1986.2*
(Dependent variable: Raw return (R_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Natural logarithm of firm size (F_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $R_{jt} = b_0 + b_1S_{jt} + b_2F_{jt} + u_{jt}$**					
0.2003#		0.0003	14.583	0.0341	0.00041
0.0377		0.0006	(0.0001)	(0.0317)	
5.301		0.473			
0.0001		0.6362			
0.0000		0.3686			
B. $R_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3F_{jt} + u_{jt}$**					
0.1917#	-0.4467#	0.0005	12.123	0.0422	0.00041
0.0377	0.1689	0.0006	(0.0001)	(0.0387)	
5.073	-2.644	0.810			
0.0001	0.0083	0.4181			
0.0000	0.0041	0.2090			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 19

Effect of dividend and firm size on the market response to positive unexpected earnings: 830 firm-quarters from 1983.4-1986.2*
(Dependent variable: Abnormal return (AR_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Natural logarithm of firm size (F_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $AR_{jt} = b_0 + b_1S_{jt} + b_2F_{jt} + u_{jt}$**					
0.1939#		0.0000	15.101	0.0352	0.00038
0.0366		0.0006	(0.0001)	(0.0329)	
5.297		0.057			
0.0001		0.9543			
0.0000		0.4771			
B. $AR_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3F_{jt} + u_{jt}$**					
0.1879#	-0.3121	0.0001	11.306	0.0394	0.00038
0.0366	0.1640	0.0006	(0.0001)	(0.0360)	
5.122	-1.903	0.301			
0.0001	0.0574	0.7635			
0.0000	0.0287	0.3817			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 20

Effect of dividend and firm size on the market response to negative unexpected earnings: 1001 firm-quarters from 1983.4-1986.2*
(Dependent variable: Raw return (R_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Natural logarithm of firm size (F_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $R_{jt} = b_0 + b_1S_{jt} + b_2F_{jt} + u_{jt}$**					
0.0154#		0.0005	4.861	0.0096	0.00051
0.0054		0.0006	(0.0079)	(0.0077)	
2.859		0.843			
0.0043		0.3997			
0.0021		0.1998			
B. $R_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3F_{jt} + u_{jt}$**					
0.0158#	-0.1688	0.0007	3.626	0.0108	0.00051
0.0054	0.1570	0.0006	(0.0128)	(0.0078)	
2.923	-1.075	1.101			
0.0035	0.2826	0.2712			
0.0017	0.1413	0.1356			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.
** The coefficient estimate on intercept (b_0) is not reported.
\# Significant at 5% level based on 2-tailed tests.

Table 21

Effect of dividend and firm size on the market response to negative unexpected earnings: 1001 firm-quarters from 1983.4-1986.2*
(Dependent variable: Abnormal return (AR_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Natural logarithm of firm size (F_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $AR_{jt} = b_0 + b_1S_{jt} + b_2F_{jt} + u_{jt}$**					
0.0135#		0.0002	3.487	0.0069	0.00050
0.0053		0.0006	(0.0310)	(0.0049)	
2.521		0.434			
0.0118		0.6645			
0.0059		0.3322			
B. $AR_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3F_{jt} + u_{jt}$**					
0.0137#	-0.1041	0.0004	2.473	0.0074	0.00050
0.0053	0.1554	0.0006	(0.0593)	(0.0044)	
2.559	-0.670	0.598			
0.0107	0.5032	0.5499			
0.0053	0.2516	0.2749			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

6.2. Dividends versus Earnings Predictability

Pincus [1983] argues that variability of unexpected returns is negatively related to predictability of earnings at the time of an earnings announcement. In the context of this study, earnings predictability should be negatively related to stock returns given the positive earnings surprise and positively related to returns given the negative earnings surprise. In the spirit of Pincus [1983] one may argue that the dividend effect demonstrated in this study is simply due to the effect of earnings predictability. That is, high dividend (large, stable) firms are those for which it is relatively easy to predict earnings whereas low dividend (small, growth) firms are relatively hard to predict.

To examine this argument, both ex post and ex ante proxies for earnings predictability are employed. Following Pincus [1983], stability of past earnings is adopted as a proxy for earnings predictability. Stability of past earnings (standard deviation of changes in earnings over a five year period: SDC) is available from Lynch, Jones and Ryan's I/B/E/S/ tape. This is an ex post measure of earnings stability. Standard deviation of analysts' forecasts of future earnings (SDF) is used as an ex ante measure of earnings predictability. This proxy is also available from the I/B/E/S/ tape. Both proxies are expected to be positively related to stock return given a positive earnings surprise and negatively related to stock return given a negative earnings surprise. The results based on these two proxies indicate that the ex ante measure (SDF_{jt}) is a better proxy than the ex post measure (SDC_{jt}).[3]

Because the earnings predictability proxies are not available for some firms, the sample size is reduced from 2126 to 1879 observations for the positive surprise group and from 2633 to 2323 observations for the negative surprise group. Summary statistics are presented in Tables 22 and 23.

First, stock return is regressed on positive earnings surprise on the basis of the reduced sample (1879 observations). As expected, the estimated coefficient is positive and significant at the 5% level. The results are presented in Panel A of Table 24 (Table 25 with abnormal

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[3] To determine which is a better proxy for earnings predictability, the following two equations are estimated:

$$R_{jt} = b_0 + b_1S_{jt} + b_2SDC_{jt} + u_{jt} \text{ and}$$

$$R_{jt} = b_0 + b_1S_{jt} + b_2SDF_{jt} + u_{jt}.$$

The results reveal that no proxy variable has a significant coefficient given positive earnings surprises. Given negative earnings surprises, however, the coefficient estimate on SDF_{jt} is statistically significant while the coefficient estimate on SDC_{jt} is insignificant again. This is more clearly demonstrated when the coefficients of the two proxies are estimated at the same time:

$$R_{jt} = b_0 + b_1S_{jt} + b_2SDC_{jt} + b_3SDF_{jt} + u_{jt}.$$

The coefficient of SDF_{jt} is significant at the 5% level while that of SDC_{jt} is not significant (t-statistic = -0.445). In this section, only the results with SDF_{jt} are reported.

return). To assess the effect of earnings predictability on stock price response to positive unexpected earnings, the following equation is estimated:

$$R_{jt} = b_0 + b_1S_{jt} + b_2SDF_{jt} + u_{jt}. \tag{6.3}$$

The results of estimating Equation (6.3) are reported in Panel B of Table 24 (Table 25 with abnormal return). The coefficient b_2 is insignificant. The sign is opposite that predicted by Pincus [1983].

To see if the dividend effect has anything to do with the earnings predictability, dividend (D_{jt}) is added to Equation (6.3):

$$R_{jt} = b_0 + b_1S_{jt} + b_2SDF_{jt} + b_3D_{jt} + u_{jt}. \tag{6.4}$$

Panel C of Table 24 (Table 25 with abnormal return) reveals that the coefficient on D_{jt} is still negative and significant while the coefficient on SDF_{jt} is insignificant. This indicates that the dividend effect found in Chapter 5 is independent of the effect of earnings predictability for the positive earning surprise group. This is accentuated in Figure 11.

Stock return is also regressed on negative earnings surprise. Results are presented in Panel A of Table 26 (Table 27 with abnormal return). Estimation of Equation (6.3) is repeated with the negative surprise group resulting in Panel

Equation (5.2)	Equation (5.3)	Equation (5.4)
$\underline{S}_{jt}$ Adj R^2 = 0.0022 F^* = 5.171[a] P = 0.0231[b]	S_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0087 F^* = 13.364 P = 0.0003	S_{jt}, D_{jt}, $\underline{SDF}_{jt}$ Adj R^2 = 0.0082 F^* = 13.357 P = 0.0003
	S_{jt}, $\underline{SDF}_{jt}$ Adj R^2 = 0.0017 F* = 0.005 P = 0.9391	S_{jt}, SDF_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0082 F^* = 0.008 P = 0.9247

[a] F^* = partial F-statistic
[b] P = p-value

Figure 11. Contribution of each of dividend and earnings predictability: Positive earnings surprises

B of Table 26 (Table 27 with abnormal return). The coefficient estimate on SDF_{jt} is statistically significant at the 5% level. But the directional relation is opposite that predicted in the context of Pincus [1983]. This indicates that, given the negative unexpected earnings, the easier to predict the earnings, the lower the stock return: that is, price change variability is positively related to predictability of earnings.

Equation (6.4) is estimated to investigate the relationship between the effects of earnings predictability and dividend given negative unexpected earnings. Results are presented in Panel C of Table 26 (Table 27 with abnormal

Equation (5.2)	Equation (5.3)	Equation (5.4)
$\underline{S}_{jt}$ Adj R^2 = 0.0050 F^* = 12.708[a] P = 0.0004[b]	S_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0046 F^* = 0.061 P = 0.7861	S_{jt}, D_{jt}, $\underline{SDF}_{jt}$ Adj R^2 = 0.0063 F^* = 4.977 P = 0.0258
	S_{jt}, $\underline{SDF}_{jt}$ Adj R^2 = 0.0067 F^* = 4.979 P = 0.0256	S_{jt}, SDF_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0063 F^* = 0.061 P = 0.8000

[a] F^* = partial F-statistic
[b] P = p-value

Figure 12. Contribution of each of dividend and earnings predictability: Negative earnings surprises

return). The coefficient on SDF_{jt} is statistically significant (5% level) whereas the coefficient on dividend D_{jt} is insignificant as in Chapter 5 (see Figure 12).

It is worthy to note in Pincus [1983] that "Results of the nonparametric rank correlation and chi-square independence procedures provide weak support (significance at about the .09 level) for the hypothesis for interim announcements only. On the other hand, significance at the .05 level is indicated for annuals, but the directional relation is opposite that predicted." Pincus [1983] argues that for interim earnings, hard-to-predict earnings and easy-to-predict earnings are announced almost at the same time (less than one day time span), but for annuals, easy-to-predict earnings are announced an average of three and one-half trading days earlier than hard-to-predict earnings. The effect would be to reduce the remaining uncertainty surrounding the earnings of late-announcing firms such that the effect of earnings predictability is confounded by the early/late-announcing phenomenon. Pincus [1983] concludes that only the results for quarterly earnings are valid and the results support the hypothesis that earnings predictability is negatively related to price change variability. The conclusion is not unambiguous. First, it is not easy to believe that the same firm has significantly different behavior for interim and annual earnings announcements. Secondly, even if they are so different, Pincus's weekly return interval might capture the timing effect of earnings announcements since easy-to-predict annuals are announced an average of less than one week earlier than hard-to-predict earnings.

One interpretation of the findings in this section is that, given the earnings surprise, a given size surprise for easy-to-predict earnings must be a real surprise and should result in a large price change. On the other hand, a surprise for hard-to-predict earnings cannot be new information because that surprise is always expected. In other words, if one lives in uncertainty, a surprise is not news to note. But this is not the case when one lives in certainty. Other interpretations may certainly be possible.

Table 22

Summary statistics: 1879 firm-quarters
(All unexpected earnings are positive.)

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Return	1879	0.00443	0.01929	-0.10039	0.10351
Abnormal return	1879	0.00354	0.01836	-0.10536	0.09527
Unexpected earnings scaled by price	1879	0.00950	0.02566	0.00001	0.48380
Dividend scaled by price	1879	0.00653	0.00487	0.00000	0.02691
Standard deviation of change in earnings (SDC_{jt})	1879	0.22929	0.19219	0.00400	0.82600
Standard deviation of forecast of future earnings (SDF_{jt})	1879	0.03478	0.04413	0.00000	1.29900

Table 23

Summary statistics: 2323 firm-quarters
(All unexpected earnings are negative.)

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Return	2323	-0.00440	0.02221	-0.17135	0.30384
Abnormal return	2323	-0.00446	0.02156	-0.16724	0.30464
Unexpected earnings scaled by price	2323	-0.03304	0.20911	-6.02842	0.00001
Dividend scaled by price	2323	0.00675	0.00504	0.00000	0.03232
Standard deviation of change in earnings (SDC_{jt})	2323	0.24253	0.19520	0.00400	0.83300
Standard deviation of forecast of future earnings (SDF_{jt})	2323	0.03428	0.03144	0.00000	0.36770

Table 24

Effect of dividend and earnings predictability on the market response to positive unexpected earnings: 1879 firm-quarters from 1983.4-1986.2*
(Dependent variable: Raw return (R_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Std. Dev. of forecasts of future earnings (SDF_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $R_{jt} = b_0 + b_1S_{jt} + u_{jt}$**					
0.0394#			5.171	0.0027	0.00037
0.0173			(0.0231)	(0.0022)	
2.274					
0.0231					
0.0105					
B. $R_{jt} = b_0 + b_1S_{jt} + b_2SDF_{jt} + u_{jt}$**					
0.0393#		0.0000	2.587	0.0028	0.00037
0.0173		0.0001	(0.0755)	(0.0017)	
2.273		0.076			
0.0231		0.9391			
0.0105		0.4695			
C. $R_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3SDF_{jt} + u_{jt}$**					
0.0320	-0.3348#	-0.0000	6.187	0.0098	0.00036
0.0173	0.0916	0.0001	(0.0004)	(0.0082)	
1.844	-3.654	-0.095			
0.0654	0.0003	0.9247			
0.0327	0.0001	0.4623			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 25

Effect of dividend and earnings predictability on the market response to positive unexpected earnings: 1879 firm-quarters from 1983.4-1986.2*
(Dependent variable: Abnormal return (AR_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Std. Dev. of forecasts of future earnings (SDF_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $AR_{jt} = b_0 + b_1S_{jt} + u_{jt}$**					
0.0410#			6.184	0.0033	0.00033
0.0164			(0.0130)	(0.0028)	
2.487					
0.0130					
0.0065					
B. $AR_{jt} = b_0 + b_1S_{jt} + b_2SDF_{jt} + u_{jt}$**					
0.0410#		0.0000	3.179	0.0034	0.00033
0.0164		0.0000	(0.0418)	(0.0023)	
2.489		0.421			
0.0129		0.6740			
0.0064		0.3370			
C. $AR_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3SDF_{jt} + u_{jt}$**					
0.0351#	-0.2725#	0.0000	5.377	0.0085	0.00033
0.0165	0.0873	0.0000	(0.0012)	(0.0069)	
2.118	-3.121	0.406			
0.0343	0.0018	0.6845			
0.0171	0.0009	0.3422			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 26

Effect of dividend and earnings predictability on the market response to negative unexpected earnings: 2323 firm-quarters from 1983.4-1986.2* (Dependent variable: Raw return (R_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Std. Dev. of forecasts of future earnings (SDF_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $R_{jt} = b_0 + b_1S_{jt} + u_{jt}$**					
0.0078#			12.708	0.0054	0.00049
0.0021			(0.0004)	(0.0050)	
3.565					
0.0004					
0.0002					
B. $R_{jt} = b_0 + b_1S_{jt} + b_2SDF_{jt} + u_{jt}$**					
0.0077#		0.0003#	8.859	0.0076	0.00049
0.0021		0.0001	(0.0001)	(0.0067)	
3.534		2.233			
0.0004		0.0256			
0.0002		0.0128			
C. $R_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3SDF_{jt} + u_{jt}$**					
0.0078#	-0.0231	0.0003#	5.925	0.0076	0.00049
0.0022	0.0913	0.0001	(0.0006)	(0.0063)	
3.542	-0.253	2.231			
0.0004	0.8000	0.0258			
0.0002	0.4000	0.0129			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 27

Effect of dividend and earnings predictability on the market response to negative unexpected earnings: 2323 firm-quarters from 1983.4-1986.2*
(Dependent variable: Abnormal return (AR_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Std. Dev. of forecasts of future earnings (SDF_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $AR_{jt} = b_0 + b_1S_{jt} + u_{jt}$**					
0.0050#			5.691	0.0024	0.00046
0.0021			(0.0171)	(0.0020)	
2.386					
0.0171					
0.0085					
B. $AR_{jt} = b_0 + b_1S_{jt} + b_2SDF_{jt} + u_{jt}$**					
0.0050#		0.0003#	5.645	0.0048	0.00046
0.0021		0.0001	(0.0036)	(0.0040)	
2.352		2.364			
0.0188		0.0182			
0.0094		0.0091			
C. $AR_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3SDF_{jt} + u_{jt}$**					
0.0050#	-0.0040#	0.0003#	3.762	0.0048	0.00046
0.0021	0.0888	0.0001	(0.0105)	(0.0036)	
2.348	-0.045	2.363			
0.0190	0.9641	0.0182			
0.0095	0.4820	0.0091			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

6.3. Dividends versus Growth

Collins and Kothari [1989] provide evidence that, given a level of earnings surprise, growth is positively associated with the magnitude of the price response. Given positive unexpected earnings, therefore, the higher the growth, the higher the stock return. Given negative unexpected earnings, the higher the growth, the lower the stock return. In this sense, one may argue that the dividend effect is found only because dividends are a proxy for growth. Low dividends may signal management's information about future growth opportunities. To see whether this argument is correct, the following two equations are estimated:

$$R_{jt} = b_0 + b_1S_{jt} + b_2G_{jt} + u_{jt}, \tag{6.5}$$

$$R_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3G_{jt} + u_{jt}, \tag{6.6}$$

where G_{jt} = a proxy for growth of firm j at time t. As a proxy for growth, analysts' forecasts of long term growth obtained from the I/B/E/S tape are used.[4]

The results of estimating Equation (6.5) are presented in Panel A of Table 28 (Table 29 with abnormal return) for positive unexpected earnings. Interestingly, the coefficient on growth G_{jt} is not significant (t-statistic = -1.016).

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[4] The sample used in this section is basically the same as that in Section 6.2. The sample size is 1879 observations for the positive surprise group and 2323 observations for the negative surprise group.

Equation (5.2)	Equation (5.3)	Equation (5.4)
$\underline{S}_{jt}$ Adj R^2 = 0.0022 F^* = 5.171[a] P = 0.0231[b]	S_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0087 F^* = 13.364 P = 0.0003	S_{jt}, D_{jt}, $\underline{G}_{jt}$ Adj R^2 = 0.0089 F^* = 1.382 P = 0.2379
	S_{jt}, $\underline{G}_{jt}$ Adj R^2 = 0.0022 F^* = 1.023 P = 0.3039	S_{jt}, G_{jt}, $\underline{D}_{jt}$ Adj R^2 = 0.0089 F^* = 13.719 P = 0.0002

[a] F^* = partial F-statistic
[b] P = p-value

Figure 13. Contribution of each of dividend and growth: Positive earnings surprises

Estimating Equation (6.6) reveals that the coefficient on dividend remains significant while that on growth is not significant (see Tables 28 and 29). This implies that the dividend effect is not affected by a growth effect. Figure 13 conveys the same message.

The estimation of Equations (6.5) and (6.6) is repeated with the negative earnings surprises resulting in Tables 30 and 31 Based on these results, Figure 14 is constructed. Figure 14 reveals that growth does not contribute to explaining the return/surprise relation given negative earnings surprises. Consequently, Figure 14 combined with

Equation (5.2)	Equation (5.3)	Equation (5.4)
S_{jt} Adj R^2 = 0.0050 F^* = 12.708[a] P = 0.0004[b]	S_{jt}, D_{jt} Adj R^2 = 0.0046 F^* = 0.056 P = 0.7861	S_{jt}, D_{jt}, G_{jt} Adj R^2 = 0.0042 F^* = 0.001 P = 0.9881
	S_{jt}, G_{jt} Adj R^2 = 0.0046 F^* = 0.001 P = 0.9815	S_{jt}, G_{jt}, D_{jt} Adj R^2 = 0.0042 F^* = 0.061 P = 0.7865

[a] F^* = partial F-statistic
[b] P = p-value

Figure 14. Contribution of each of dividend and growth: Negative earnings surprises

Figure 13 indicate that the dividend effect is independent of a growth effect.

The results provide evidence that growth does not impact the stock return given unexpected earnings. This is inconsistent with Collins and Kothari [1989]. The methodologies of this and the Collins and Kothari study differ in several respects, and this may account for the inconsistent conclusions. For instance, Collins and Kothari use market-to-book value equity ratios as a proxy for growth whereas analysts' forecasts of growth are used in this study. Collins and Kothari's (market value/book value) ratio is related to the q ratio (market value/replacement cost of assets) used in this study. Either analysts' forecast or q ratio may be a better proxy for growth than a market-to-book value ratio since the former are market-determined figures. Also, Collins and Kothari do not analyze positive and negative earnings surprises separately.

Table 28

Effect of dividend and growth on the market response to positive unexpected earnings: 1879 firm-quarters from 1983.4-1986.2*
(Dependent variable: Raw return (R_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Analysts' forecasts of growth (G_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $R_{jt} = b_0 + b_1S_{jt} + b_2G_{jt} + u_{jt}$**					
0.0356#		-0.0097	3.101	0.0033	0.00037
0.0178		0.0083	(0.0452)	(0.0022)	
2.002		-1.169			
0.0454		0.2425			
0.0227		0.1212			
B. $R_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3G_{jt} + u_{jt}$**					
0.0311	-0.3395#	-0.0000	6.653	0.0105	0.00036
0.0174	0.0916	0.0000	(0.0002)	(0.0089)	
1.790	-3.703	-1.181			
0.0737	0.0002	0.2379			
0.0368	0.0001	0.1189			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.
** The coefficient estimate on intercept (b_0) is not reported.
\# Significant at 5% level based on 2-tailed tests.

Table 29

Effect of dividend and growth on the
market response to positive unexpected earnings:
1879 firm-quarters from 1983.4-1986.2*
(Dependent variable: Abnormal return (AR_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Analysts' forecasts of growth (G_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $AR_{jt} = b_0 + b_1S_{jt} + b_2G_{jt} + u_{jt}$**					
0.0403#		-0.0000	3.625	0.0038	0.00033
0.0165		0.0000	(0.0268)	(0.0028)	
2.443		-1.032			
0.0147		0.3021			
0.0073		0.1510			
B. $AR_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3G_{jt} + u_{jt}$**					
0.0341#	-0.2772#	-0.0000	5.784	0.0092	0.00033
0.0165	0.0873	0.0000	(0.0007)	(0.0076)	
2.060	-3.173	-1.173			
0.0395	0.0015	0.2410			
0.0197	0.0007	0.1205			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 30

Effect of dividend and growth on the market response to negative unexpected earnings: 2323 firm-quarters from 1983.4-1986.2*
(Dependent variable: Raw return (R_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Analysts' forecasts of growth (G_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $R_{jt} = b_0 + b_1S_{jt} + b_2G_{jt} + u_{jt}$**					
0.0078#		-0.0000	6.352	0.0054	0.00049
0.0021		0.0000	(0.0018)	(0.0046)	
3.564		-0.023			
0.0004		0.9815			
0.0002		0.4907			
B. $R_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3G_{jt} + u_{jt}$**					
0.0078#	-0.0247	-0.0000	4.257	0.0055	0.00049
0.0022	0.0915	0.0000	(0.0054)	(0.0042)	
3.574	-0.271	-0.015			
0.0004	0.7865	0.9881			
0.0002	0.3932	0.4940			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Table 31

Effect of dividend and growth on the market response to negative unexpected earnings: 2323 firm-quarters from 1983.4-1986.2*
(Dependent variable: Abnormal return (AR_{jt}))

Independent Variables			Regression Statistics		
Earnings surprise scaled by price (S_{jt})	Dividend scaled by price (D_{jt})	Analysts' forecasts of growth (G_{jt})	F value (Prob>F)	R-square (Adjusted)	MSE
A. $AR_{jt} = b_0 + b_1S_{jt} + b_2G_{jt} + u_{jt}$**					
0.0051#		0.0000	2.849	0.0024	0.00046
0.0021		0.0000	(0.0581)	(0.0016)	
2.385		0.091			
0.0171		0.9278			
0.0085		0.4639			
B. $AR_{jt} = b_0 + b_1S_{jt} + b_2D_{jt} + b_3G_{jt} + u_{jt}$**					
0.0051#	-0.0059	-0.0000	1.900	0.0025	0.00046
0.0021	0.0889	0.0000	(0.1257)	(0.0012)	
2.383	-0.067	-0.093			
0.0173	0.9465	0.9262			
0.0086	0.4732	0.4631			

* Standard errors, t-statistics, p value based on 2-tailed test, and p value based on 1-tailed test, respectively, appear beneath the independent variable parameter estimates.

** The coefficient estimate on intercept (b_0) is not reported.

\# Significant at 5% level based on 2-tailed tests.

Chapter 7. Summary and Conclusions

7.1. Summary of the Empirical Results

The evidence of Chapter 5 indicates that, in a study of market response to earnings announcements, data should be analyzed separately according to the sign of earnings surprise. When a regression is run on the entire sample, all the factors (dividend, q ratio, beta) appear to impact the return/surprise relation in section 5.1. However, a separate analysis on positive and negative surprises provides different results. The results of the matched-pair t-test in section 5.2 show that the equity market response is asymmetric between positive and negative earnings surprises. The market reacts more strongly to positive earnings surprise than to negative earnings surprise. Given a positive earnings surprise, the factors have a statistically significant impact on the return/surprise relation. But all the factors of Chapter 5 turn out to be unimportant with a negative earnings surprise. This suggests that the equity market reacts to earnings surprise through different functional mechanisms depending on whether the earnings surprise is positive (good news) or negative (bad news).

The results of the separate analyses in section 5.2 show that dividend is the most important of the factors examined. The results indicate that dividend policy is an important factor to be considered in studies of the relationship between equity return and earnings surprise.

In Chapter 6, analyses are made to examine whether the dividend effect differs from the firm size, earnings predictability, and growth effects found by other studies. The results in section 6.1 reveal that the dividend effect is distinguished from the effect of firm size found in Atiase [1985] and Freeman [1987]. The addition of a firm size variable to the regression (Equation (4.6)) does not weaken the dividend effect. When the information environment is controlled, the effect of dividend is still apparent for positive surprises while the effect of firm size disappears. The results suggest that the dividend effect is not a proxy for differential information.

The evidence of section 6.2 indicates that dividend is not a proxy for earnings predictability. The addition of an earnings predictability proxy to the regression does not change the results. The results of regressing stock return on earnings surprise and earnings predictability provide evidence inconsistent with Pincus [1983]. Given the positive earnings surprise, earnings predictability has no association with market response. Given the negative earnings surprise, earnings predictability plays an important role. Interestingly, however, the directional relation is opposite that predicted by Pincus [1983]. Since this study uses quarterly data, the timing effect suggested by Pincus should not matter. Based on these results the following interpretation is suggested. Firms with less predictable earnings streams react less to a given earnings surprise than firms with more predictable earnings streams. The surprise means more to the predictable firm than to the unpredictable firm. Another way of stating this is that the 'unexpected' surprise delivers more information than the 'expected' surprise.

In section 6.3, it is revealed that the dividend effect is not the same as the growth effect identified by Collins and Kothari [1989]. A growth effect is not supported by this study. The results are not consistent with Collins and Kothari [1989].

This study finds that heteroskedasticity does not create problems in return/surprise studies. This is consistent with Christie [1987]. The GLS estimator controlling for heteroskedasticity reduces to the OLS estimator in this study.

The results of Chapters 5 and 6 evidence that the return/surprise relation is essentially the same whether one uses raw return or abnormal return as a dependent variable. This is consistent with Beaver, Lambert and Morse [1980], Beaver, Lambert and Ryan [1987], and Collins and Kothari [1989]. This implies that, relative to the variability in raw return around earnings announcements, the variability in expected return based on systematic risk is small.

Finally, the positive and negative earnings surprise groups are different in terms of q ratio. The matched-pair t-test reveals that q ratio is higher for the positive group than for the negative group. But systematic risk and dividend yield are not different for the two groups.

The findings for each variable examined in this study are summarized below.

Factor	Positive surprise (good news)	Negative surprise (bad news)
Dividend	strong support	no support
Q ratio	weak support[a]	no support
Systematic risk	no support	weak support[b]
Firm size	weak support	strong support
Earnings predictability	no support	strong support[c]
Growth	no support	no support

a Weak support is defined as significance at the 15% level.

b The directional relation is opposite that predicted by Equation (3.19).

c The directional relation is opposite that predicted by Pincus [1983]. Strong support is defined as significance at the 5% level.

Figure 15. Summary of results

7.2. Conclusions

This study theoretically and empirically identifies factors contributing to stock price response to earnings announcements. Chapter 5 provides evidence that dividend policy is an important factor to be considered in return/surprise studies. One may argue that dividend is found important simply because it is a proxy for firm size, earnings predictability, or economic growth. But the empirical results of Chapter 6 show that dividend has its own explanatory power. The dividend effect is only apparent for positive earnings surprises. Positive earnings surprise and dividend policy combined provide very useful information to the investment community. That information may signal management's inside information about the firm's unrealized investment opportunities.

Evidence in this study has several implications for interpreting the findings in previous research and for future research. First, the results show that market beta, empirically found important by Collins and Kothari [1989], does not impact the return/surprise relation. In particular, with negative earnings surprise, the directional relation is opposite that found by Collins and Kothari [1989]. The results are consistent with Jain [1981]. This conflict should be addressed by future research. As always, there is a need to replicate the study on different sets of firms, over different time periods, and using alternative methodologies.

Second, given the results of this study, the relationship between earnings predictability and market reaction is opposite that predicted by Pincus [1983]. The results indicate that variability of price change is positively related to earnings predictability. As an extension, different data can be analyzed. More importantly, one may examine returns variability associated with other types of announcements.

Also, the evidence of the results on growth is inconsistent with Collins and Kothari [1989]. Collins and Kothari use the ratio of market to book value as a proxy for growth while security analysts' forecasts of growth are used in this study. This is an issue which will benefit from further research.

One of the most important findings is that the equity market reaction is asymmetric between positive and negative earnings surprises. The response is stronger to positive earnings surprise. It may reflect the psychology of the market or general economic conditions. Again, it would be fruitful to replicate the study on different sets of data and using different methodologies. Differential market responses to good and bad news may depend on whether the market is a bull market or a bear market. This can be found by investigating different or expanded time series.

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