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ANALYSTS' ANNUAL EARNINGS FORECAST REVISIONS AROUND INTERIM EARNINGS ANNOUNCEMENTS

by

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Abstract

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This study examines, both analytically and empirically, how the properties of interim earnings affect analysts' annual earnings forecast revisions around interim earnings announcements. My rational expectations model of analysts' forecast revisions allows analysts to acquire private information in both the pre-announcement and announcement periods. In each period, the properties of the private information are determined by the property of the public information it will be used to interpret. The model predicts the following: 1) Analysts' average forecast revisions are positively associated with both the surprise and precision of interim earnings. The associations are stronger the earlier the announcements are in the year. 2) The change in analysts' forecast dispersion is positively associated with the interim earnings surprise and pre-announcement information precision and negatively associated with interim earnings precision. 3) Analysts' forecast jumbling is positively associated with the surprise and precision of interim earnings and negatively associated with pre-announcement information precision. Using I/B/E/S analysts' earnings forecast data and the pooled OLS linear regression method, I find the empirical evidence that is consistent with the predictions about analysts' average forecast revisions and the change in forecast dispersion. However, the empirical evidence does not reject the null hypothesis about analysts' forecast jumbling.

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Chapter 1

Introduction

1.1. Research Questions

Interim earnings announcements prompt analysts to revise their forecasts of firms' future earnings (Stickel 1989). This study examines, both analytically and empirically, how analysts use earnings information to revise their future earnings forecasts. Assuming that earnings is a random variable, previous studies show that both the ***surprise*** - the difference between actual and expected earnings - and the ***precision*** - the reciprocal of earnings variance - of earnings convey information, and that the surprise and the precision complement each other. For example, Subramanyam (1996) conducts theoretical analysis and Freeman and Tse (1992) conduct empirical analysis. Previous studies also examine three properties of analysts' earnings forecast revisions: (1) ***average orecast revision***, (2) ***change in forecast dispersion*** (change in the extent of agreement), and (3) ***forecast jumbling*** (change in relative forecast position). They show that each property captures a unique aspect of analysts' revisions, and all contribute to stock market movements such as price and volume changes (e.g., Beaver 1968, Barron 1995, and Bamber et al. 1997). This study tests how the interim earnings ***surprise*** and ***precision*** affect the three properties of analysts' annual earnings forecast revisions.

Figure 1 illustrates the interaction between the ***surprise*** and the ***precision*** of earnings, and the importance of examining them simultaneously. In Figure 1, the earnings of firms A and B, X(A) and X(B), are assumed to be normally distributed with a zero mean. However, the precision of X(A) is 16 and the precision of X(B) is 1. If actual earnings for both firms are $0.75, then the surprise for both firms is $0.75. The probability of a surprise that is more extreme than $0.75 for X(A) is 0.0013, but for X(B), it is 0.2266. In other words, given the earnings distributions, it is highly unlikely that Firm A would observe a surprise of $0.75. For Firm B, however, a surprise of $0.75 is a likely draw from the earnings distribution. Consequently, analysts are more likely to believe that Firm A's earnings distribution has changed from the expected distribution (that is, the mean is greater than zero). However, analysts are not as likely to think that Firm B's earnings distribution is different from the expected distribution.

Figure 2 illustrates how ***average forecast revision***, ***change in forecast dispersion***, and ***forecast jumbling*** capture different aspects of analysts' forecast revisions. Each panel of Figure 2 presents a situation in which the important characteristics of forecast revisions are captured by one of the three measures only, but not by the other two. Panel A of Figure 2 has neither change in forecast dispersion nor forecast jumbling, but the average forecast has increased. Panel B of Figure 2 has neither average forecast revision nor forecast jumbling, but forecast dispersion has decreased. Panel C of Figure 2 has neither average forecast revision nor change of forecast dispersion, but two analysts have swapped their forecast positions, that is, forecast jumbling has occurred.

1.2. Relevance of the Study

The relationship between earnings announcements and analysts' future earnings forecast revisions is one of the basic links assumed in earnings information content studies. Theories about earnings' information content posit a systematic relationship among earnings announcements, investors' belief revisions and stock market reactions (e.g., Ball and Brown 1968 and Beaver 1968). Specifically, an earnings announcement contains information if it alters investors' beliefs. Investors' belief revisions will then cause changes in their behaviour. Thus, investors' belief revisions provide a link for the relationship between earnings announcements and stock market reactions (Panel A of Figure 3). Since we cannot observe investors' beliefs, accounting researchers often use published analysts' earnings forecasts as proxies for them. By so doing, researchers assume a parallel relationship among earnings announcements, analysts' earnings forecast revisions, and stock market reactions (Panel B of Figure 3). Early empirical studies focused on the link between earnings and stock market reactions (Link 3 in Panel B, Figure 3). More recently, researchers have studied the link between analysts' earnings forecast revisions and stock market reactions (Link 2 in Panel B, Figure 3). However, little empirical work has systematically examined the link between earnings and analysts' forecast revisions (Link 1 in Panel B, Figure 3). This study clarifies some aspects of that relationship.

In addition to directly testing the assumptions made in earnings information content studies, this study is also of interest to accountants, business managers and financial analysts. It examines how average earnings forecast revisions, forecast dispersion, and forecast jumbling are affected by interim earnings announcements. These properties of financial analysts' earnings forecast revisions reflect the estimation risk and information asymmetry among investors, and eventually link to the cost of capital (Miller 1977, Jarrow 1980, Figlewski 1982, Mayshar 1983, Atiase 1985, Barry and Brown 1985, Glosten and Milgrom 1985, Coles and Lowenstein 1988, and Clarkson and Thompson 1990,).

1.3. Summary of Tests and Findings

I develop a rational expectations model to analyze analysts' annual earnings forecast revisions around interim earnings announcements. From the model, I derive the following hypotheses. 1) Analysts' average forecast revisions are positively associated with both the surprise and the precision of interim earnings. The earlier the announcements are in the year, the stronger the associations are. 2) The change in analysts' forecast dispersion is positively associated with interim earnings surprise and pre-announcement information precision, and negatively associated with interim earnings precision. 3) Analysts' forecast jumbling is positively associated with the surprise and precision of interim earnings and negatively associated with pre-announcement information precision. Using detailed I/B/E/S analysts' forecast data, I find the following results: a) The association between analysts' average annual earnings forecast revisions and the surprise in interim earnings is significantly affected by the precision of interim earnings. The association is positive when interim earnings precision is high, but negligible or even negative when interim earnings precision is low. b) For interim earnings with high precision, the magnitude of analysts' forecast revisions decreases as the year progresses. c) On average, the dispersion of annual earnings forecasts decreases (forecasts converge) around the interim earnings announcements. d) The annual earnings forecast convergence is negatively associated with the absolute value of the surprise in interim earnings and the precision of pre-announcement information and is positively associated with the precision of interim earnings. e) On average, annual earnings forecast jumbling increases around the interim earnings announcements. The increased jumbling, however, is not systematically associated with the measures of the interim earnings I studied.

1.4. Organization of the Study

The rest of this study is organized as follows: Chapter 2 reviews the relevant literature. Chapter 3 develops an analytical model and derives the testable hypotheses. Chapter 4 discusses the test methodology and defines the variables. Chapter 5 describes the data and the summary statistics. Chapter 6 presents the results of empirical tests. Chapter 7 presents several tests of robustness. Chapter 8 summarizes the study.

Chapter 2

Literature Review

Research about earnings information content, interim earnings, and analysts' earnings forecasts is relevant to this study. These three streams of research are reviewed in this chapter.

2.1. Earnings Information Content Research

Capital markets-oriented research on earnings information content began in the 1960s, when the efficient market hypothesis became widely accepted in finance and accounting. Fama (1970) describes a market as efficient if the security prices fully reflect the information available. In the semi-strong form of the efficient markets hypothesis, all publicly available information, including that contained in earnings announcements, is impounded in stock prices. Assuming the semi-strong form of an efficient market as the maintained hypothesis, earnings information content research uses capital market reactions, such as stock returns and trading volume, to test the information content of earnings.[1]

[1] Besides stock returns and trading volume, stock price variance (Beaver 1968 and Easton and Zmijewski 1989) and stock option price change (Skinner 1990) are also used as a measure of market reaction.

Because stock returns do not capture the heterogeneity among investors (Beaver 1968), trading volume is examined in addition. Theoretically, earnings announcements affect both the consensus and the distribution of investors' beliefs. Investors' belief revisions can result in price change alone, trading volume alone, or both price change and trading volume (Beaver 1968, Holthausen and Verrecchia 1990, and Kim and Verrecchia 1991). Empirically, disparity in return and volume reactions to earnings announcements is found about 25% of the time. In other words, for about one-quarter of the earnings announcements, a large stock price change is accompanied by minimal trading, or vice versa (Bamber and Cheon 1995). In addition to the relationship between earnings announcements and market reactions (link 3 in Panel A and B of Figure 3), empirical studies on earnings information content also examine the relationship between analysts' forecast revisions and market reactions (link 2 in Panel B of Figure 3) and earnings announcements and analysts' forecast revisions (link 1 in Panel B of Figure 3). The empirical research on the three links is reviewed in more detail in the following sections.

2.1.1. Earnings and Market Reactions (link 3)

Ball and Brown (1968) empirically test the relationship between the abnormal performance index (API) and earnings surprise. They document a positive association between stock returns and the surprise in the earnings announcement (the difference between announced earnings numbers and their expected values based on a random-walk model for earnings). Specifically, firms with good news (positive surprises) enjoy, on average, positive abnormal stock returns, and firms with bad news (negative surprises) experience, on average, negative abnormal stock return.

Beaver et al. (1979) refined Ball and Brown's study by taking into consideration the magnitude, as well as the direction, of the surprise in earnings announcements. They find a positive association between the magnitude of the earnings surprise and abnormal stock returns. Following Beaver et al. (1979), further refinements were made to strengthen the earnings return association in areas such as 1) the measure of returns, 2) return windows, 3) actual earnings, 4) expected earnings, 5) other relevant explanatory variables (see Lev 1989 for a review), and, more recently, 6) non-linear earnings/return relationship.

The linear model assumes that all earnings have the same persistence. However, given the uncertainty in the business environment and the current accounting system, earnings persistence is likely to change. The various non-linear models adopted in recent studies allow the persistence of earnings to vary and achieve a stronger return/earnings association (Cheng et al. 1992, Freeman and Tse 1992, Das and Lev 1994, Hayn 1995 and Basu 1997). Some sources of lack of persistence in earnings identified in these studies include accounting conservatism (Basu 1997), possibility of liquidation (Hayn 1995), and special items in earnings (Das and Lev 1994). Das and Lev (1994) show that the non-linear effect persists even after excluding special items. Freeman and Tse (1992) attribute the non-linear relationship to the more generally defined transitory earnings. Subramanyam (1996) formalizes the relationship theoretically and shows that when *ex ante* uncertainty regarding the precision of information is allowed, the price response to earnings information is neither linear nor even necessarily monotonic.

Trading volume is found to increase at the time of earnings announcements (Beaver 1968 and Morse 1981). Further, the trading volume around earnings announcements and the absolute value of the surprise in earnings announcements are positively associated (Bamber 1986, 1987).

In summary, empirical studies find that a non-linear relationship between stock returns and earnings surprise is more descriptive than the linear relationship adopted in earlier studies. Also, studies show a positive association between trading volume and earnings surprise.

2.1.2. Analysts Forecast Revisions and Market Reactions (link 2)

More recently, empirical research has been extended to the relationship between analysts' forecast revisions and stock market reactions. Stock returns are found to be positively associated with the average analysts' earnings forecast revision (Brown et al. 1985 and L'Her and Suret 1996) and to be negatively associated with analysts' earnings forecast dispersion (L'Her and Suret 1996).

Trading volume is found to relate to a number of properties of analysts' earnings forecasts and forecast revisions. The trading volume of a firm is found to be positively associated with the analysts' forecast dispersion in March each year (Comiskey et al. 1987). Monthly trading volume is found to be positively associated with analysts' mean forecast revisions each month, the forecast dispersion of each month (Ajinkya et al. 1991), the monthly change in forecast dispersion, the magnitude of dispersion, and monthly forecast jumbling (Barron 1995). Trading volume is also found to be positively associated with the change in forecast dispersion, the magnitude of forecast dispersion, and forecast jumbling coincident with interim earnings announcements (Bamber et al. 1997).

With the exception of Bamber et al. (1997), the studies of the relationship between analysts' forecast revisions and market reactions do not specify the information events that trigger both analysts' forecast revisions and market reactions. Bamber et al. (1997) study the relationship between trading volume and analysts' annual earnings forecast revisions coincident with interim earnings announcements, implicitly assuming that interim earnings announcements are responsible for the analysts' forecast revisions.

If analysts' forecast revisions reflect investors' belief revisions, an empirical investigation of the relationship between analysts' earnings forecast revisions and stock market reactions will illuminate the relationship between investors' belief revision and market reaction.

2.1.3. Earnings and Analysts' Forecast Revisions (link1)

Although no researcher has systematically studied the relationship between analysts' future earnings forecast revisions and earnings announcements, a few papers have examined individual aspects of this relationship. For example, Brown and Rozeff (1979) find Value Line analysts' annual earnings forecast accuracy improve significantly after interim announcements. Analysts' annual earnings forecast revisions are found to be positively associated with the interim earning forecast error and the association weakens as the year progresses (Abdel-Khalik and Espejo 1978, Brown et al. 1980 and Abdel-Khalik 1983). Analysts' response to interim earnings forecast error also differs when the interim earnings are accurately reported and when they are erroneously overstated (Ettredge et al. 1995). Specifically, Ettredge et al. (1995) find that analysts react to positive earnings surprise *more strongly* if the earnings are accurately reported than if overstated, and that analysts react to negative earnings surprise *less strongly* if the earnings are accurately reported than if overstated. If overstatement errors in earnings can be viewed as poor earnings precision, then the Ettredge et al. (1995) results are consistent with analysts' reactions to earnings surprise being a function of earnings precision.

The cross-sectional variance of analysts' future earnings forecasts is found to change around earnings announcements. Using I/B/E/S summary data, Morse et al. (1991) find that, contrary to prior belief, analysts' future year earnings variance increases around the current years' earnings announcements. Using only the recent forecasts from detail I/B/E/S data, Brown and Han (1992) find that on average, analysts' future year earnings forecast variance decreases after current year earnings announcements. They also rank their sample by the absolute value of earnings surprise and group them in 10 deciles. They find significant decreases in dispersion for the seven smallest deciles and a significant increase in dispersion only for the largest decile.

2.2. Quarterly Earnings

Extensive effort has been devoted to studying the time-series properties of quarterly earnings (e.g., Foster 1977). Seasonally differenced quarterly earnings are shown to have an auto-regressive structure, with the coefficients of the first three lags being positive and decreasing over the lags and the fourth lag being negative (Bernard and Thomas 1990). Rangan and Sloan (1998) show that because of the integral approach to quarterly reporting, the auto-regressive nature of seasonally differenced quarterly earnings is more profound for quarters in the same fiscal year. That is, the auto-regressive coefficients are larger when the quarters are in the same fiscal year.

Interim earnings are found to differ systematically from annual (fourth quarter) earnings, and the market reacts differently to fourth quarter earnings from interim earnings. Specifically, the fourth quarter earnings forecast errors are significantly greater than those of the three interim quarters (Collins et al. 1984 and Basu et al. 1997), and the stock price reactions to the "bad news" in interim earnings are significantly stronger than to the "bad news" in fourth quarter earnings (Mendenhall and Nichols 1988). Basu et al. (1998) argue that this is because interim earnings are not audited and fourth quarter earnings are audited as part of the annual earnings. The conservatism of auditors causes more losses to be reported in the fourth quarter earnings. Consequently, the fourth quarter earnings are more conservative than interim earnings. The losses that do get reported in interim earnings are more likely to represent non-reversible permanent losses and, therefore, result in a stronger market reaction.

2.3. Analysts' Earnings Forecasts

Analysts' earnings forecasts are interesting to accounting researchers largely because they proxy for investors' expectations in capital market research. Researchers have examined several properties of analysts' earnings forecasts including their accuracy, their association with stock returns, and their bias. The commonly used analysts' forecast data bases are also examined.

Analysts earnings forecasts are found to be more accurate than previous period earnings (random walk model forecasts) and various time-series forecasts. The superiority of analysts' forecasts is the result of their relative information and timing advantages. Consistently, greater accuracy is found when more alternative information is available, such as for larger firms, and when earnings variability is greater (Brown and Rozeff 1978). Consensus analysts' forecasts can be improved when pooled with forecasts from other sources, such as time-series forecasts (Conroy and Harris 1987 and Lee and Chen 1990) and stock price-based forecasts (Elgers and Murray 1992), suggesting analysts do not use all the available public information. Analysts' forecast accuracy increases as the forecast horizon shortens (O'Brien 1988); therefore, excluding stale forecasts can improve the consensus forecasts accuracy (Brown 1991 and Brown and Han 1992). The most accurate forecasts do not necessarily have the highest association with stock returns (Foster 1977).

Studies on analysts' forecast bias find that analysts' forecasts are optimistically biased (Fried and Givoly 1982, O'Brien 1988, and Francis and Philbrick 1993). The bias is more prominent for firms whose stocks are recommended as "sell" or "hold" stocks (Francis and Philbrick 1993), when analysts are on the sell-side (Dugar and Nathan 1995 and Lin and McNichols 1997), when a firm suffers losses (Hwang et al. 1996), and when the forecasts are for the fourth quarter of the fiscal year (Basu et al. 1997). When firms that report losses are separated from those that report profits, the optimistic bias in quarterly earnings exists only for loss firms, and pessimistic bias exists for profit firms (Brown 1998).

The analysts' forecasts used in accounting research are mainly from the *Value Line Investment Survey*, the Institutional Brokers Estimate System (*I/B/E/S*), and, to a lesser extent, the *Standard and Poor's Earnings Forecaster* and Zacks Investment Research. Comparing the forecasts from these sources shows that absolute forecast errors computed using the *Value Line* forecast earnings per share with *the Value Line* actual earnings per share are the smallest. The forecast error computed using *Value Line* actual earnings and either *Value Line* or *I/B/E/S* has the strongest association with three-day abnormal returns (Philbrick and Ricks 1991). A closer examination reveals that whether the actual earnings reported by the forecast databases include non-recurring gains and losses varies across forecasts in *Value Line* and *I/B/E/S*.

The actual earnings, however, appear to be adjusted to match the forecasts target (Skantz and Pierce 1997). Thus, it is important to match the forecasts with actual earnings to mitigate the problem of incomparable target. The alternative interpretation is that the selective adjustment overstates analysts' forecast accuracy.

In summary, because of their superior accuracy to time-series forecasts, analysts' earnings forecasts are widely accepted as the proxy for investors' beliefs in earnings information content research. However, both the accuracy of analysts' forecast and the association between forecast error and stock returns vary among the major data bases used in accounting research. Further, both earnings and analysts' forecasts show different properties between interim quarters and the fourth quarter.

Chapter 3

A Model of Analysts' Earnings Forecast Revisions

No extant analytical model specifically examines analysts' future earnings forecast revisions around earnings announcements. However, investors' belief revisions around earnings announcements are often discussed when the impact of earnings announcements on stock price and trading volume is being analyzed. Three models are particularly relevant in predicting investors' belief revisions around earnings announcement, i.e., those of Kim and Verrecchia (1991), Holthausen and Verrecchia (1990), and Kim and Verrecchia (1998). This chapter discusses these three models, and then extends them in a new model designed to analyze the impact of interim earnings announcements on analysts' annual earnings forecast revisions.

3.1. Relevant Extant Analytical Models

All three relevant models assume a three-period setting with two assets: a risky asset (firm) and a riskless bond. In period 1, investors are endowed with one unit of riskless bond. Investors obtain information to estimate the liquidating value of the firm and trade accordingly. Investors also anticipate the forthcoming earnings announcement. In period 2, investors observe a public earnings announcement that conveys information about the firm's value. Investors revise their beliefs of the firm value and trade accordingly. In period 3, the firm pays off its liquidating value. Despite the common setting, these three models make different assumptions about the information flows, and thus arrive at different predictions. The rest of this section on relevant analytical models briefly discusses the assumptions and predictions of each model.

3.1.1. Kim and Verrecchia 1991 Model (KV '91)

The KV '91 model assumes that investors have the same pre-announcement *public* information but differ in the precision of their *private* pre-announcement information. Investors form their beliefs of the firm's value based on their pre-announcement information. Investors with highly precise pre-disclosure private information are more confident in their beliefs; by contrast, investors with less precise pre-disclosure information are less confident in their beliefs. In other words, investors' pre-announcement beliefs differ only in their confidence levels. When earnings are publicly announced, all investors interpret their implication for the firm's value identically. The difference in investors' pre-announcement private information, however, causes investors to place different weights on the new information and, therefore, to differ in their belief revisions. The weight investors place on the announcement information reflects the "relative importance of the newly announced information [and] is increasing in the precision of the announcement and decreasing in the precision of the pre-announcement information" (Kim and Verrecchia, 1991, p302). The diversity in the weighting of the new information results in differential belief revisions and, therefore, different beliefs among investors after the announcement.

3.1.2. Holthausen and Verrecchia 1990 Model (HV '90)

The HV '90 model assumes that investors have homogeneous information about the distribution of the firm value and, therefore, homogeneous beliefs before the earnings announcement. When earnings are announced, investors receive public information and interpret its implication on the firm's value. Although all investors observe identical public information, their interpretations of what the public information implies about the value of the firm are not homogeneous. The model introduces an investor-specific factor, i.e., private information that varies among individuals, that affects investors' interpretations of the earnings in the announcement period. The investor-specific factor results in investors having "heterogeneous expectations after the information is released" (Holthausen and Verrecchia 1990).

3.1.3. Kim and Verrecchia 1998 Model (KV '98)

The KV '98 model assumes that investors acquire private information before and after the earnings announcement. The precision of the pre-announcement and announcement period private information varies across investors. Earnings announcements convey information about a firm's value with some noise, which can be thought of as the result of "the application of random, liberal, or conservative accrual-based accounting practices and estimates" (Kim and Verrecchia 1998). The private information investors acquire during the announcement period is used to gauge the implication of the noise in earnings announcements on a firm's value. This model treats the announcement period private information acquisition as endogenously determined by investors' desire to better understand the announced earnings. The more private information acquired, the more investors will interpret the earnings differently.

3.2. The Model of Analysts' Forecast Revisions

3.2.1. The General Assumptions of the Model

To analyze the impact of interim earnings announcements on analysts' annual earnings forecast revisions, I focus on two periods around interim earnings announcements in my model: the pre-announcement and the announcement period. Several analysts predict a firm's earnings, and an analyst may follow several firms. In the pre-announcement period, analysts predict both the annual earnings and the current quarter's earnings. The information used in this period includes both public and private information. The private information is used to interpret the noise in the public information. In the announcement period, the quarterly earnings is released. The quarterly earnings is a public signal that has the implication for the annual earnings. Private information again is gathered to help interpret the noise in the quarterly earnings. Analysts revise their annual earnings forecasts using both pre-announcement and announcement period information.

Generally, I assume that the public information about a particular firm i, in year t, denoted B, conveys information about a firm's annual earnings, denoted, y, with some noise, denoted n (subscripts i and t are suppressed for simplicity). n is normally distributed with mean zero and precision ω, $0<\omega<1$. The parameters of the noise distribution are public knowledge. However, the realized value of the noise in the public information, denoted $\check{n}$, is unknown.

Analysts can choose not to collect any private information and rely on their knowledge about the distribution of the noise in the public information only to form their annual earnings forecasts. If so, then the expected noise in the public information is zero. Therefore, these analysts' forecast of annual earnings of firm i in year t will be

$$F(y|B) = y+\check{n}. \qquad (1)$$

The forecast error of firm i's earnings in year t of all analysts, thus, is

$$\begin{aligned} E[F(y|B)-y]^2 &= E(y+\check{n}-y)^2 \\ &= E(\check{n})^2 \\ &= Var(n) = 1/\omega. \qquad (2) \end{aligned}$$

Alternatively, analysts can try to partition out the realized value of the noise in the public information by collecting additional private information, denoted V_j for analyst j. The private information unmasks a portion of the realized value of the noise in the public information but also introduces a noise, denoted e, that is uncorrelated with the noise in the public information, n. For analyst j, $V_j = \rho\check{n}-\check{e}_j$, where $0<\rho<1$. $\check{e}_j$ is the realized value of the noise, e ,in analyst j's private information. e is normally distributed with mean zero and precision v. Analyst j's forecast of firm i's earnings in year t based on both the private and the public information, denoted $F(y|B, V_j)$, is

$$F(y|B, V_j) = y+\check{n}-\rho\check{n}+\check{e}_j$$

$$= y+(1-\rho)\check{n}+\check{e}_j,\ \forall\ j. \quad (3)$$

The forecast error of firm i's earnings forecasts of all analysts based on both the public and the private information, thus, is

$$E[F(y|B, V_j)-y]^2 = E[y+(1-\rho)n+\check{e}_j-y]^2$$

$$= E[(1-\rho)\check{n}+\check{e}_j]^2$$

$$= (1-\rho)^2 Var(n)+Var(e)$$

$$= (1-\rho)^2/\omega+1/v. \quad (4)$$

If analysts' objective is to reduce the overall earnings forecast error, then, the necessary condition for any private information collection to incur is

$$(1-\rho)^2/\omega+1/v <1/\omega. \quad (5)$$

One particular specification of the distributions of the noises in both the public and the private information that will satisfy this condition is

$$1/v = \rho^2/\omega. \quad (6)$$

Proof:

$(1-\rho)^2/\omega+1/v$

$= (1-\rho)^2/\omega+\rho^2/\omega$

$= 1/\omega -2\rho(1-\rho)/\omega$

$<1/\omega$, since $0<\rho<1$.

This specification has certain intuitively attractive properties. It suggests that, firstly, the noise in a particular firm's private information should be less than the noise in the firm's public information. Otherwise, the private information would not be useful in reducing the forecast error. Secondly, the variance of the noise in the private information is a positive function of the amount of the private information that analysts collect. The more analysts want to unmask the noise in the public information, the more private information they will collect. By definition, analysts' private information should be at least partially uncorrelated with each other. Therefore, the more private information analysts collect, the bigger the variance of the noise in the private information.[2]

3.2.2. The Pre-announcement Period

In the pre-announcement period in my model, all analysts observe some public information, denoted B_1, that conveys information about firm i's annual earnings, denoted y, with some noise, denoted n_1. The noise in the public information is normally distributed with mean zero and precision ω_1, $0<\omega_1<1$. The general distribution of the noise in public information is public knowledge. However the realized value of the noise in the public information, $\check{n}_1$, is unknown.

If analysts choose to form their annual earnings forecasts based on the public information and their knowledge of the distribution of the noise in it only, analysts will assume that the realized value of the noise is zero. Therefore, all analysts will have identical annual earnings forecast:

$$F_j(y|B_1) = y+\check{n}_1, \forall j. \tag{7}$$

The noise contained in the public information results in lack of accuracy in analysts' forecasts. The desire to reduce the error in their forecasts motivates analysts to acquire private information. Assume analyst j acquires private

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[2] The amount of private information an analyst collects is determined by 1) the cost of information and 2) the benefit from the information. Modeling this dynamic cost-benefit tradeoff is beyond the scope of my study. Therefore, I do not attempt to infer the optimal value of ρ.

information V_{1j}. V_{1j} unmasks a portion of the noise in the pubic information with some analyst specific noise, denoted e_1. That is, $V_{1j} = \rho\check{n}_1 - \check{e}_{1j}$, where $0<\rho<1$, $\check{e}_{1j}$ is the realized value of e_1 in analyst j's forecast. e_1 is normally distributed with mean zero and precision v_1, $0<v_1<1$. e_1 is uncorrelated with n_1. Thus, analyst j's annual earnings forecast based on pre-announcement period public and private information, denoted F_{1j}, is

$$\begin{aligned} F_{1j} &= F_j(y|B_1,V_{1j}) \\ &= y+\check{n}_1-\rho\check{n}_1+\check{e}_{1j} \\ &= y+(1-\rho)\check{n}_1+\check{e}_{1j},\ \forall\ j. \end{aligned} \tag{8}$$

As discussed earlier, I choose the following specification for the distributions of the noises in public and private information:

$$1/v_1 = \rho^2/\omega_1. \tag{9}$$

The same information set is also used to predict upcoming quarterly earnings, denoted z_q. *If I assume no seasonal variation, then analyst j's annual* earnings forecast before quarter q earnings announcement, $F_j(y|B_1, V_{1j})$, and his/her forecast of quarter q earnings, denoted $F_j(z_q|B_1, V_{1j})$, should have the following relationship:

$$F_j(y|B_1, V_{1j}) = \check{z}_1+\ldots+\check{z}_{q-1}+(5-q)F_j(z_q|B_1, V_{1j}), \tag{10}$$

where $\check{z}_1$, ..., $\check{z}_{q-1}$ are actual earnings of quarter 1 through quarter q-1. This suggests that analysts' earnings forecasts of all the remaining quarters in the year are same as those of quarter q.[3]

3.2.3. The Announcement Period

In the announcement period, analysts receive the actual earnings of quarter q, $\check{z}_q$. The difference between the actual quarterly earnings, $\check{z}_q$, and analyst j's forecasted quarterly earnings, $F_j(z_q|B_1, V_{1j})$, is the surprise in the interim earnings perceived by analyst j, denoted d_{qj}. That is,

$$d_{qj} = \check{z}_q - F(z_q|B_1, V_{1j}). \tag{11}$$

I assume $-1<d_{qj}<1$. The average surprise in the public information of announcement period, denoted d_q, therefore, is the average of surprise to all analysts and $-1<d_q<1$.

$$d_q = Avg(d_{qj}) \tag{12}$$

[3] If this assumption is relaxed, the relationship will hold with a slight modification. Assume that quarter earnings follow a positive auto-regressive structure with auto-regression coefficients of k_1, k_2, and k_3 for the first three lags, where $k_i>0$, i = 1, 2, 3. The average annual earnings forecasts after and before first quarter earnings will have the following relationship: $F(y|B_2) = F(y|B_1)+(k_1+k_2+k_3)d_1$. The positive auto-regressive structure for the first three lags of quarterly earnings is well documented (e.g., Bernard and Thomas 1990) and greater auto-regressive coefficients are found for quarters in the same fiscal year (Rangan and Sloan 1998). Investors seem to under-estimate the auto-regressive nature of quarterly earnings and this, argued Bernard and Thomas (1990), is responsible for the post-earnings announcement drift. However, Ball and Bartov (1996) show that investors do seem to correctly anticipate about 50% of the relationship.

The actual quarterly earnings, $\check{z}_q$, is the only signal in the public information of the announcement period, denoted B_2. This public information conveys information about the annual earnings with some noise, denoted n_2. n_2 is normally distributed with mean zero and precision ω_2, $0<\omega_2<1$. To facilitate an interpretation of the noise in public information, n_2, analyst j acquires private information, denoted V_{2j}. V_{2j} unmasks a portion of the noise in the public information, n_2, with some analyst specific noise, denoted e_2. That is $V_{2j} = \rho\check{n}_2 - \check{e}_{2j}$. The noise in analysts' private information, e_2, is normally distributed with mean zero and precision v_2, $0<v_2<1$. The noise in analysts' private information, e_2, is uncorrelated with the noise in the public information, n_2.

The specification of the distributions of the noise in the public and private information in this period is modified to include the impact of surprise in analysts' private information acquisition. Intuitively, I assume that the greater the average surprise in quarterly earnings, the more private information analysts' will collect. Thus, I have

$$1/v_2 = \rho^2|d_q|/\omega_2.^{4} \qquad (13)$$

[4] This modification of the specification of the distributions of the noises in the public and private information does not upset the necessary condition for private information collection.

Proof:

Similar to the derivation in equation (2), the total forecast error using the public information, B_2, only is $1/\omega_2$.

Similar to the derivation in equation (4), the total forecast error using both the public information, B_2, and the private information, V_{2j}, $\forall$ j, is $(1-\rho)^2/\omega_2+1/v_2$.

$$(1-\rho)^2/\omega_2+1/v_2$$
$$= (1-\rho)^2/\omega_2+\rho^2|d_q|/\omega_2$$
$$= 1/\omega_2 - \rho(1-\rho)/\omega_2 - \rho(1-\rho|d_q|)/\omega_2 < 1/\omega_2 \text{, since } 0<\rho<1 \text{ and } 0<|d_q|<1.$$

The annual earnings forecast based only on the announcement period information by analysts j, denoted $F_j(y|B_2, V_{2j})$ is

$$F_j(y|B_2, V_{2j})$$

$$= y+(1-\rho)\check{n}_2+\check{e}_{2j}, \ \forall \text{analyst } j. \tag{14}$$

Similar to existing models, I assume that analysts use both the pre-announcement period and announcement period information to revise their forecasts. The importance of pre-announcement information and announcement period information depends on their relative precision. That is, the more precise or less noisy the information, the more analysts will rely on it. Since the private information in both the pre-announcement and announcement periods is to be used in conjunction with public information only, the private information has the same importance as the public information. For simplicity, i assume n_1, e_{1j}, n_2, and e_{2j} are uncorrelated with one another. Analyst j's annual earnings forecast in the announcement period, denoted F_{2j}, is

$$F_{2j} = F_j(y|B_1, B_2, V_{1j}, V_{2j})$$

$$= [\omega_1/(\omega_1+\omega_2)]\ F_j(y|B_1, V_{1j})+[\omega_2/(\omega_1+\omega_2)]\ F_j(y|B_2, V_{2j})$$

$$= [\omega_1/(\omega_1+\omega_2)][y+(1-\rho)\check{n}_1+\check{e}_{1j}]+[\omega_2/(\omega_1+\omega_2)][y+(1-\rho)\check{n}_2+\check{e}_{2j}]$$

$$= y+[\omega_1/(\omega_1+\omega_2)][(1-\rho)\check{n}_1+\check{e}_{1j}]+[\omega_2/(\omega_1+\omega_2)][(1-\rho)\check{n}_2+\check{e}_{2j}] \tag{15}$$

If all the future quarterly earnings in the current year are assumed to be same, then based on the announcement period public information only, analyst j's earnings forecasts of all the remaining quarters in the current year should be same as the actual earnings of quarter q, $\check{z}_q$. Analyst j's annual earnings forecast based only on announcement period public information, $F_j(y|B_2)$, therefore, can written as

$$F_j(y|B_2, V_{2j}) = \check{z}_1+\ldots+\check{z}_{q-1}+(5-q)\,\check{z}_q. \qquad (16)$$

Note that

$$F_j(y|B_2)-F_j(y|B_1, V_{1j})$$
$$= (5-q)[\check{z}_q-F_j(z_q|B_1, V_{1j})]$$
$$= (5-q)d_{qj} \qquad (17)$$

Equation (17) indicates that the announcement period public information suggests that analyst j's forecasts of all the remaining quarters' earnings of the year should be revised by the surprise he/she perceived in the quarter q's earnings.

Including the private information in the announcement period, analyst j's annual earnings forecast based only on announcement period information becomes

$$F_j(y|B_2, V_{2j}) = \check{z}_1+\ldots+\check{z}_{q-1}+(5-q)\,\check{z}_q-\rho\check{n}_2+\check{e}_{2j}. \qquad (18)$$

Since I assume that analysts use both pre-announcement and announcement period information to revise their annual earnings forecasts, analyst j's revised annual earnings forecast in the announcement period, F_{2j}, can also be related to the his/her forecast and the actually reported quarter q's earnings.

$$
\begin{aligned}
F_{2j} &= F(y|B_1, B_2, V_{1j}, V_{2j}) \\
&= [\omega_1/(\omega_1+\omega_2)]F_{1j}(y|B_1, V_{1j})+[\omega_2/(\omega_1+\omega_2)]\ F_{2j}(y|B_2, V_{2j}) \\
&= [\omega_1/(\omega_1+\omega_2)][\check{z}_1+\ldots+\check{z}_{q-1}+(5-q)F_j(z_q)]+ \\
&\qquad +[\omega_2/(\omega_1+\omega_2)][\check{z}_1+\ldots+\check{z}_{q-1}+(5-q)\check{z}_q-\rho\check{n}_2+\check{e}_{2j}] \\
&= [\check{z}_1+\ldots+\check{z}_{q-1}+(5-q)F_j(z_q)]+ \\
&\qquad +[\omega_2/(\omega_1+\omega_2)](5-q)[\check{z}_q-F_j(z_q)]\ +[\omega_2/(\omega_1+\omega_2)][-\rho\check{n}_2+\check{e}_{2j}] \\
&= F_{1j}(z|B_1, V_{1j})+\ [\omega_2/(\omega_1+\omega_2)](5-q)d_{qj}+[\omega_2/(\omega_1+\omega_2)][-\rho\check{n}_2+\check{e}_{2j}] \qquad (19)
\end{aligned}
$$

My model extends the existing models in three ways. Firstly, different analyst can have different earnings forecast numbers in both the pre-announcement and the announcement periods. This is more descriptive than the models that assume same expectation for all investors (HV'90) or expectations differ only in their confidence level (KV'91). Secondly, unlike the existing models that exogenously determine importance (weights) of various sources of information, my model endogenously determines the importance (weights) of the pre-announcement and announcement private period information by the characteristics of the information. Lastly, my model substitutes the firm value in the existing models for the expected annual earnings. This substitution should not change the fundamental analysis because in finite periods, predicting a firm's liquidating value is equivalent to predicting a firm's accumulated earnings. These extensions make my model more descriptive. They also allow the analysis of differential revisions, such as a change in dispersion and jumbling, as well as the consensus revisions.

3.3. The Hypotheses

3.3.1. The Average Forecast Revisions

Analyst j's annual earnings forecast revision around quarter q's earnings announcement, denoted $\Delta F_j(y)$, is the difference between his/her forecasts in the announcement and pre-announcement periods. Using equation (10) and equation (19), I have:

$$\begin{aligned}\Delta F_j(y) &= F_{2j}-F_{1j} \\ &= F_{1j}(y|B_1, V_{1j})+[\omega_2/(\omega_1+\omega_2)](5-q)d_{qj}+[\omega_2/(\omega_1+\omega_2)][-\rho\check{n}_2+\check{e}_{2j}]- \\ &\qquad -F_j(y|B_1, V_{1j}) \\ &= [\omega_2/(\omega_1+\omega_2)](5-q)d_{qj}+[\omega_2/(\omega_1+\omega_2)][-\rho\check{n}_2+\check{e}_{2j}] \qquad (20)\end{aligned}$$

The analysts' average annual earnings forecast revisions around quarter q's earnings announcement, denoted $\Delta F(y)$, therefore, is

$$\Delta F(y) = Avg[\Delta F_j(y)]$$

$$= Avg\{[\omega_2/(\omega_1+\omega_2)](5-q)d_{qj}\}$$

$$= [\omega_2/(\omega_1+\omega_2)](5-q)Avg(d_{qj})$$

$$= [\omega_2/(\omega_1+\omega_2)](5-q)d_q \tag{21}$$

Equation (21) suggests that the impact of a unit of earnings surprise on analysts' average forecast revisions is $[\omega_2/(\omega_1+\omega_2)](5-q)$. The coefficient should be positive and increase with the precision of interim earnings, ω_2, and decrease with the distance to the fiscal year end, q. Intuitively, the more precise the interim earnings, the more likely the surprise in them is caused by a change in their distributions and the more responsive analysts will be in their forecast revisions. The less precise the earnings, the more likely the surprise in the earnings is caused by random variation in their distributions and the less responsive analysts will be in their forecast revisions. The earlier in the year and the more quarters still remaining in the year, the greater the annual earnings will be affected by the surprise. Stated formally in alternative form, we have Hypothesis 1:

H1: Financial analysts' annual earnings forecast revisions around the interim earnings announcement are positively associated with the surprise in the interim earnings announcement. The association strengthens with the precision of interim earnings and weakens with the forecast horizon.

3.3.2. The Change in Forecast Dispersion

The forecast dispersion reflects the level of agreement among analysts and can be measured by the variance of analysts' forecasts.[5] The change in forecast dispersion, therefore, can be measured by the change in analysts' forecast variances around quarterly earnings announcements, denoted $\Delta Var[F(y)]$.

$$\Delta Var[F(y)] = Var[F_2]-Var[F_1] \tag{22}$$

Using the individual analyst's annual earnings forecasts in the pre-announcement period in Equation (8), the variance of the analysts' forecast in the pre-announcement period, denoted $Var(F_1)$, is

$$\begin{aligned} Var(F_1) &= Var[F_j(y|B_1,V_{1j})] \\ &= Var[y+(1-\rho)\check{n}_1+\check{e}_{1j}] \\ &= Var(y)+Var[(1-\rho)\check{n}_1]+Var(\check{e}_{1j}) \\ &= (1-\rho)^2/\omega_1+1/v_1 \\ &= (1-\rho)^2/\omega_1+\rho^2/\omega_1 \\ &= [(1-\rho)^2+\rho^2]/\omega_1 \end{aligned} \tag{23}$$

[5] Using variance simplifies the analysis. To be consistent with previous studies, I use standard deviation of all qualified forecasts in my empirical tests.

Using the individual analyst's annual earnings forecasts in the announcement period in Equation (15), the variance of analysts' forecast variance in the announcement period, denoted $Var(F_2)$, is

$$Var(F_2) = Var[F_j(y|B_1,V_{1j}, B_2,V_{2j})]$$
$$= Var\{y+[\omega_1/(\omega_1+\omega_2)][(1-\rho)\check{n}_1-\acute{e}_{1j}]+[\omega_2/(\omega_1+\omega_2)][(1-\rho)\check{n}_2-\acute{e}_{2j}]\}$$
$$= Var(y)+[\omega_1/(\omega_1+\omega_2)]^2 Var[(1-\rho)\check{n}_1-\acute{e}_{1j}]+[\omega_2/(\omega_1+\omega_2)]^2 Var[(1-\rho)\check{n}_2-\acute{e}_{2j}]$$
$$= [\omega_1/(\omega_1+\omega_2)]^2[(1-\rho)^2/\omega_1+\rho^2/\omega_1)+[\omega_2/(\omega_1+\omega_2)]^2[(1-\rho)^2/\omega_2+\rho^2|d_q|/\omega_2]$$
$$= (1-\rho)^2/(\omega_1+\omega_2)+\rho^2(\omega_1+\omega_2|d_q|)/(\omega_1+\omega_2)^2 \quad (24)$$

$$\Delta Var[F(y)] = Var[F_2]-Var[F_1]$$
$$= (1-\rho)^2/(\omega_1+\omega_2)+\rho^2(\omega_1+\omega_2|d_q|)/(\omega_1+\omega_2)^2-[(1-\rho)^2+\rho^2]/\omega_1 \quad (25)$$

To gauge how the absolute value of interim earnings surprise ($|d_q|$), interim earnings precision, (ω_2), and pre-announcement information precision (ω_1) affect the change in analysts forecast dispersion, $\Delta Var[F(y)]$, I take partial derivatives of equation (25) with respect to each of these variables:

$$\partial\{\Delta Var[F(y)]\}/\partial|d_q| = \rho^2\omega_2/(\omega_1+\omega_2)^2>0 \quad (26)$$

$$\partial\{\Delta Var[F(y)]\}/\partial\omega_2 = -(1-\rho)^2/(\omega_1+\omega_2)^2+\rho^2|d_q|/(\omega_1+\omega_2)^2-\rho^2(\omega_1+\omega_2|d_q|)/(\omega_1+\omega_2)^3$$
$$= -(1-\rho)^2/(\omega_1+\omega_2)^2-\rho^2\omega_1(1-|d_q|)/(\omega_1+\omega_2)^3$$
$$< 0, \text{ since } 0<|d_q|<1. \quad (27)$$

$$\partial\{\Delta Var[F(y)]\}/\partial \omega_1$$

$$= -(1-\rho)^2/(\omega_1+\omega_2)^2+\rho^2/(\omega_1+\omega_2)^2-\rho^2(\omega_1+\omega_2|d_q|)/(\omega_1+\omega_2)^3$$

$$+[(1-\rho)^2+\rho^2]/\omega_1^2$$

$$=(1-\rho)^2[1/\omega_1^2-1/(\omega_1+\omega_2)^2]+\rho^2/\omega_1^2+\rho^2\omega_2(1-|d_q|)/(\omega_1+\omega_2)^3$$

$$>0, \text{ since } 0<|d_q|<1,\ 0<\omega_2<1, \text{ and } 0<\omega_1<1 \qquad (28)$$

The partial derivatives in inequalities (26) through (28) indicate that the change in analysts' forecast dispersion around interim earnings announcements increases with the absolute value of interim earnings surprise, $|d_q|$, decreases with the interim earnings precision, ω_2, and increases with the pre-announcement information precision, ω_1. Intuitively, interim announcements provide all analysts with the same public information that has implications for the annual earnings. The greater the interim earnings surprise, the more important the interim earnings, and the more the private information analysts acquire to help their interpretations. Thus, the greater the interim earnings surprise, the less the analysts' forecasts will converge (or the more analysts' forecasts will diverge). This is consistent with Bamber's (1987) argument that bigger surprises are more likely to result in a wider variety of interpretations. Second, the more precise the interim earnings, the more weight analysts will place on it and the more analysts' forecasts will converge (or the less analysts' forecast will diverge). Finally, the less precise the pre-announcement information, the larger the forecast dispersion before the announcement, and the more likely interim earnings announcements will reduce the dispersion. Thus, the second hypothesis can be formally stated in alternative form:

H2: The change in analysts' annual earnings forecasts dispersion around interim earnings announcements is positively associated with the absolute value of the interim earnings surprise and pre-announcement information precision. The change in analysts' forecast dispersion is negatively associated with the interim earnings precision.

The significance of the impact of interim earnings surprise and precision on the change of analysts forecast dispersion are determined by the relevant importance of the interim earnings. As the year progresses, more and more other information about the annual earnings becomes available and, therefore, reduces the importance of interim earnings. On the other hand, as the year progresses and closer the fiscal year end becomes, more relevant the interim earnings become and, therefore, more important the interim earnings become. Which effect will dominate is an empirical question and, therefore, will be answered by the empirical evidence.

3.3.3. Forecast Jumbling

Karpoff (1986) suggests that a differential belief revision on a public information release could take place in the form of "heterogeneous disagreement among traders, but it does not necessarily reflect disagreement among traders" (p.1084). Barron (1995) interprets it as "changes in the relative position of individual expectations within the distribution of all expectations (e.g., two forecasts swap positions)" and calls it "jumbling". By definition, jumbling reflects the lack of correlation between analysts' forecast made in pre-announcement and announcement periods. Therefore, I use the complement of the correlation coefficient of analysts' forecasts before and after interim announcements for analysis. The forecast jumbling is denoted by ψ.

$$\psi = 1\text{-Corr}[F_j(y|B_1,V_{1j}),\ F_j(y|B_1,V_{1j},\ B_2,V_{2j})]$$

$$= 1\text{-Cov}[F_j(y|B_1,V_{1j}),\ F_j(y|B_1,V_{1j},\ B_2,V_{2j})]/$$

$$/\{Var[F_j(y|B_1,V_{1j})]Var[F_j(y|B_1,V_{1j},\ B_2,V_{2j})]\}^{(1/2)}$$

$$= 1\text{-Cov}\{y+(1-\rho)\check{n}_1-\check{e}_{1j},\ y+[\omega_1[(1-\rho)\check{n}_1-\check{e}_{1j}]+\omega_2[(1-\rho)\check{n}_2-\check{e}_{2j}]]/(\omega_1+\omega_2)\}/$$

$$\{Var[y+(1-\rho)\check{n}_1-\check{e}_{1j}]Var\{y+[\omega_1[(1-\rho)\check{n}_1-\check{e}_{1j}]+\omega_2[(1-\rho)\check{n}_2-\check{e}_{2j}]]/(\omega_1+\omega_2)\}^{(1/2)}$$

$$= 1-\{[(1-\rho)^2+\rho^2]/\ (\omega_1+\omega_2)\}/$$

$$/\{[[(1-\rho)^2+\rho^2]/\omega_1]\{\omega_1[(1-\rho)^2+\rho^2]+\omega_2[(1-\rho)^2+\rho^2|d_q|]\}/(\omega_1+\omega_2)^2\}^{(1/2)}$$

$$= 1-\{(1/\omega_1)[\omega_1+\omega_2[(1-\rho)^2+\rho^2|d_q|]/[(1-\rho)^2+\rho^2]]\}^{(-1/2)} \qquad (29)$$

To gauge how the absolute value of interim earnings surprise, $|d_q|$, interim earnings precision, ω_2, and pre-announcement information precision, ω_1, affect analysts forecast jumbling, ψ, I take partial derivatives of equation (29) with respect to these variables.

$$\partial\psi/\partial|d_q| = (½)\{(1/\omega_1)[\omega_1+\omega_2[(1-\rho)^2+\rho^2|d_q|]/[(1-\rho)^2+\rho^2]]\}^{(-3/2)}$$
$$\{\omega_2\rho^2/[(1-\rho)^2+\rho^2]\omega_1\}>0 \qquad (30)$$

$$\partial\psi/\partial\omega_2 = (½)\{(1/\omega_1)[\omega_1+\omega_2[(1-\rho)^2+\rho^2|d_q|]/[(1-\rho)^2+\rho^2]]\}^{(-3/2)}$$
$$\{[(1-\rho)^2+\rho^2|d_q|]/[(1-\rho)^2+\rho^2]\omega_1\}>0 \qquad (31)$$

$$\partial\psi/\partial\omega_1 = -(½)\{(1/\omega_1)[\omega_1+\omega_2[(1-\rho)^2+\rho^2|d_q|]/[(1-\rho)^2+\rho^2]]\}^{(-3/2)}$$
$$\{\omega_2[(1-\rho)^2+\rho^2|d_q|]/[(1-\rho)^2+\rho^2]\omega_1^2\}<0 \qquad (32)$$

The partial derivatives in inequalities (30) through (32) indicate that analysts' forecast jumbling around interim announcements increases with the absolute value of an interim earnings surprise, $|d_q|$, and in the interim earnings precision, ω_2, and decreases in pre-announcement information precision, ω_1. Intuitively, the greater the interim earnings surprise, the more important interim earnings are to analysts and the more private information analysts acquire. The difference in analysts' private information causes analysts to interpret interim earnings differently, and thus, to change their relative forecast positions. The more precise the pre-announcement information, the more analysts will rely on it and retain their old forecasts, and the less their relative forecast positions will change. Lastly, the higher the precision of the interim earnings, the more analysts will rely on it, and the less they will rely on the pre-announcement information. Consequently, more analysts will leave their old forecast positions and form new forecasts. Therefore, a change in analysts' relative forecast position is more likely. The third hypothesis can be formally stated in alternative form as follows:

H3: Financial analysts' annual earnings forecast jumbling around interim earnings announcements is positively associated with the absolute value of interim earnings surprise and negatively associated with the precision of pre-announcement information.

The significance of the impact of interim earnings surprise and precision on analysts' forecast jumbling again is determined by the relative importance of the interim earnings. As the year progresses the relative importance of interim earnings is driven in the opposite directions by the increase of other information and the increasing relevance of the interim earnings. Since I have no basis to determine which factor will dominate, I do not predict the change in impact of interim earnings surprise and precision on analysts' forecast jumbling over the interim quarters. Rather, I will let empirical evidence answer the question.

Chapter 4

Research Methods and Variable Definitions

4.1. Regression Models

The ordinary least squares (OLS) regression is used to test hypotheses. For all hypotheses, a pooled cross-sectional regression is conducted separately for each interim quarter.

H1: Average Forecast Revisions

Hypothesis 1 predicts a positive association between average forecast revisions and earnings surprise. The association strengthens with the precision of interim earnings. To test this hypothesis, analysts' average forecast revisions are regressed on surprise and the interactive term of surprise and precision:

Model: $AvgRev = \alpha + \beta\,(UX) + \gamma\,(UX^{*}D) + \varepsilon$ (R1)
Predicted sign: (+, 0, -) (+)

AvgRev denotes average forecast revisions, *UX* denotes the surprise, and *D* denotes the precision of earnings. Since the earnings precision is a dummy variable with one for more precise earnings and zero for less precise earnings (see Section 4.2 for definition), the coefficient on earnings surprise, β, represents analysts' average forecast revisions in response to earnings surprise when interim earnings precision is low. In the actual regression, *AvgRev* is the average forecast revision for the remaining future quarters of the year only. Therefor, the coefficient β is expected to be positive, zero, or negative because when interim earnings precision is low, analysts' response to earnings can be small but positive, small and negligible, or negative if analysts believe that a big bath is taken and reversal will follow. Subramanyam (1996) shows that, under the assumption that the precision of earnings is negatively correlated with the absolute value of surprise, uncertainty regarding the precision of earnings can cause a non-monotonic price response to earnings. If this analysis can be generalized to the relationship between analysts' forecast revisions and earnings announcements, it means that a negative association between average forecast revisions and earnings surprise is possible. The coefficient on the interactive term, γ, captures the difference in analysts' reaction to earnings surprise between high and low precision, that is, the difference between *D* is 1 and zero. The hypothesis predicts that higher precision enhances analysts' response to interim earnings and, thus, γ should be positive. The sum of the coefficients on surprise and the interactive term, $\beta+\gamma$, represents analysts' forecast revision in response to an earnings surprise when earnings precision is high. It is expected to be positive. Hypothesis 1 also predicts that the impact of interim earnings weakens as the year progresses, and thus, regression coefficients γ and $\beta+\gamma$ should be smaller for the later quarters in the year.

H2: Change in Forecast Dispersion

Hypothesis 2 predicts that the change in analysts' forecast dispersion is positively associated with the absolute value of earnings surprise, negatively associated with interim earnings precision, and positively associated with the precision of pre-announcement information. For this hypothesis, I regress the change in forecast dispersion on the earnings surprise, interim earnings precision, and pre-announcement information precision:

Model: $\Delta Disp = \alpha + \beta|UX| + \gamma D + \lambda\, PreD + \varepsilon$ *(R2)*

Predicted sign: (+) (-) (+)

ΔDisp denotes the change in forecast dispersion, *|UX|* denotes the absolute value of earnings surprise, *D* denotes the precision of interim earnings, and *PreD* denotes the precision of pre-announcement information. The coefficient on the absolute value of earnings surprise, β, should be positive because the larger the surprise, the less the forecasts will converge (or the more the forecast will diverge). The coefficient on earnings precision, γ, should be negative because the more precise the interim earnings, the more the forecasts will converge (or the less the forecasts will diverge). The coefficient of pre-announcement precision, (λ), should be negative since the more precise the pre-announcement information, relatively speaking, the less precise the announcement period information and, therefore, the less the forecasts will converge (more the forecasts will diverge).

H3: Forecast Jumbling

Hypothesis 3 predicts that forecast jumbling is positively associated with the absolute value of surprise and interim earnings precision and negatively associated with pre-announcement information precision. Analysts' forecast jumbling is regressed on the absolute value of earnings surprise, the interim earnings precision, and the pre-announcement information precision:

Model: $Jumb = \alpha + \beta|UX| + \gamma D + \lambda\, PreD + \varepsilon$ (R3)
Predicted sign (+) (+) (-)

Jumb denotes the forecast jumbling. $|UX|$, *D*, and *PreD* are same as in the previous section. The coefficient on the absolute value of surprise, β, should be positive because the greater the surprise, the more private information analysts will acquire and the more likely a change will be in relative forecast position. The coefficient on earnings precision, γ, should be positive because the more precise the interim earnings, the more analysts will rely on them, revise their old forecasts, and change their forecast positions. The coefficient of pre-announcement precision, λ, should be negative because the more precise the pre-announcement information, the more analysts will rely on them, maintain their old forecasts, and therefore be less likely to change their forecast positions.

4.2. The Variables

To test these hypotheses requires the specification of pre- and post-announcement periods so that analysts' forecast revision will reflect the impact of interim earnings announcements. Following Barron (1995) and Bamber et al. (1997), I specify the pre-announcement period as the period of 45 days before an interim announcement date, and a post-announcement period of 30 days after an interim announcement date. The pre-announcement period is allowed to be longer than the post-announcement period because analysts tend to postpone their forecast release until after an interim earnings announcement.

Average Revision ($AvgRev_{iqt}$)

Analysts' average forecast revision of firm i's earnings in year t around quarter q earnings announcement, ($AvgRev_{iqt}$), is the difference between the average forecast of firm i's earnings in year t after and before quarter q earnings announcement deflated by the previous period closing stock price. That is,

$$AvgRev_{iqt} = \{\Sigma_j[F_{jq+}(y_{it})-F_{jq-}(y_{it})]\}/(m_{iqt}P_{iq-1}) - [\check{z}_{iqt}-F(z_{iqt})]/P_{iq-1},$$

where

y_{it}:	*firm i's earnings per share in year t*
P_{iq-1}:	*firm i's period q-1 closing stock price*
m_{iqt}:	*number of qualified forecast revisions for firm i, quarter q, in year t*
$F_{jq+}(.)$:	*analyst j's forecast released in the period of 30 days after quarter q's earnings announcement (from detailed I/B/E/S files)*
$F_{jq-}(.)$:	*analyst j's forecast released in the period of 45 days before quarter q's earnings announcement (from detailed I/B/E/S files)*
$\check{z}_{iqt}$:	*firm i's actual earnings of quarter q in year t*
$F(.)$:	*analysts' average quarterly earnings forecasts.*

Change in Forecast Dispersion ($\Delta Disp_{iqt}$)

The change in forecast dispersion of firm i in year t around quarter q earnings announcement, ($\Delta Disp_{iqt}$), is the difference between the standard deviation of all forecasts of firm i's earnings in year t after and before the announcement deflated by the previous period closing stock price. That is

$$\Delta Disp_{iqt} = PostDisp_{iqt} - PreDisp_{iqt},$$

where

$PostDisp_{iqt}$: $\{\Sigma_j[F_{jq+}(y_{it})-F_{q+}(y_{it})]^2/(m_{iqt}-1)\}^{(1/2)}/(P_{iq-1})$

$PreDisp_{iqt}$: $\{\Sigma_j[F_{jq-}(y_{it})-F_{q-}(y_{it})]^2/(m_{iqt}-1)\}^{(1/2)}/(P_{iq-1})$

$F_{q+}(.)$: $\Sigma_j F_{jq+}(.)/m_{iqt}$

$F_{q-}(.)$: $\Sigma_j F_{jq-}(.)/m_{iqt}$.

Forecast Jumbling ($Jumb_{iqt}$)

To measure the forecast jumbling of the forecasts of firm i in year t around quarter q ($Jumb_{iqt}$), I use the simple correlation of all the forecasts of firm i in year t in the pre-announcement period of quarter q and post-announcement period of quarter q. To be consistent with the term jumbling, that is larger values represent more jumbling, I invert the correlation coefficient. That is,

$$Jumb_{iqt} = 1-Corr(F_{jq+}(y_{it}), F_{jq-}(y_{it})).$$

Surprise (UX_{iqt})

The surprise in firm i's earnings of quarter q in year t, (UX_{iqt}), is the difference between the actual earnings and analysts' average forecast of firm i's earnings of quarter q in year t in the pre-announcement period of quarter q deflated by the previous period closing stock price. That is,

$$UX_{iqt} = [z_{iqt} - F(\check{z}_{iqt})]/P_{iq-1},$$

where
$\check{z}_{iqt}$: *firm i's actual earnings of quarter q in year t*
$F(.)$: *analysts' average quarterly earnings forecasts.*

Precision (D)

A direct measure of earnings precision is rare in the accounting literature. Subramanyam (1996) argues that earnings precision reflects the persistence of earnings, that is, the more the transitory components in earnings, the less precise the earnings.

Three proxies for earnings precision are developed based on the persistence of earnings. The first is based on whether the earnings surprise is extreme. Freeman and Tse (1992) argue that transitory earnings are likely to be associated with extreme earnings surprises. The potential benefit to forecasting transitory earnings is small, so analysts put less effort into forecasting them. Consequently, transitory earnings are likely to have larger forecast errors. Since stock prices react less to transitory earnings, an "S-shape" return/earnings relationship should exist. Their results indeed show an "S-shape" return/earnings relationship. In light of this discussion, I rank my sample of each quarter by the magnitude of absolute surprise in interim earnings. If the earnings surprise of firm i, quarter q, in year t is in the bottom 90% of the ranking, then I consider its precision to be high. If the earnings surprise of firm i, quarter q, in year t is in the top 10% in the ranking, then I consider its precision to be low. A dummy variable is used:

> D_{iqt} = *1 if the absolute value of the earnings surprise firm I, quarter q in year t is in the bottom 90%; 0 otherwise.*

The second proxy is based on whether a firm reports a profit or loss. Basu (1997) argues that since accounting conservatism usually requires "bad news" to be reported in a more timely manner than "good news," bad news tends to be reported more concurrently, while good news tends to be spread over several periods. He predicts, and finds, consistent empirical evidence that negative earnings surprises reverse more often than positive earnings surprises, indicating that negative earnings surprises are more transitory than positive earnings surprises. Similar evidence is reported by Brooks and Buckmaster (1976), Hayn (1995) and Elgers and Lo (1994). In addition, Hwang, Jan and Basu (1996) find that analysts on average provide far more optimistic earnings forecasts for loss firms than for profit firms because, they infer, losses are more transitory. In the spirit of the above argument, if firm i reports profits in quarter q in year t, the precision is considered high. A dummy variable is used:

> D_{iqt} = *1 if firm i reports profit in quarter q in year t; 0 otherwise.*

The third proxy of earnings precision is based on a direct measure of the transitory components in earnings, i.e., the extraordinary items. If firm i reports no extraordinary items in quarter q year t, the precision is considered high. If firm i reports extraordinary items in quarter q year t, the precision is considered low. A dummy variable is used:

> D_{iqt} = *1 if firm i reports no extraordinary item in quarter q year t; 0 otherwise.*

Pre-announcement Information Precision ($PreD_{iqt}$)

The pre-announcement information precision is measured by the inverse of pre-announcement forecast dispersion. The pre-announcement information, including both public and private information, should directly reflect the extent of agreement among analysts. The more precise the information, the more analysts agree and the smaller the forecast dispersion.

$$PreD_{iqt} = 1 - PreDisp_{iqt} = \{\Sigma_j[F_{jq-}(y_{it}) - F_{q-}(y_{it})]^2/(m_{iqt}-1)\}^{(1/2)}/(P_{iq-1}).$$

Analysts' pre-announcement forecast dispersion is used to compute the change in forecast dispersion, i.e., ΔDisp=PostDisp-PreDisp. Therefore, analysts' pre-announcement forecast dispersion will appear on the both sides of regression model (R2) because regression model (R2) can be written as

$$PostDisp - PreDisp = \alpha + \beta|UX| + \gamma D + \lambda(1 - PreDisp) + \varepsilon \qquad (R2\text{-}1)$$

Including the same variable on both sides of the regression will inflate the regression R^2. To avoid this problem, the pre-announcement information precision is added to both sides of the equation (R2-1).

$$PostDisp = (\alpha + \lambda) + \beta|UX| + \gamma D + (1-\lambda)\ PreDisp + \varepsilon \qquad (R2\text{-}2)$$

The revised regression model, therefore, becomes

Model: $PostDisp = \alpha' + \beta|UX| + \gamma D + \lambda'\ PreDisp + \varepsilon$ (R2')
Predicted sign: (+) (-) (+)

In regression (R2') $\alpha'=\alpha+\lambda$ and $\lambda'=1-\lambda$. λ is predicted to be positive in regression (R2). By definition, the value of analysts forecast dispersion variable and the precision of both interim earnings and pre-announcement information variable is between zero and one. Therefore, the regression coefficient on precision of pre-announcement information in regression (R2), λ, should be also less than one. This leads to the prediction that the coefficient on pre-announcement period forecast dispersion in regression (R2'), λ', is positive.

The Appendix summarizes the definitions of the variables.

Chapter 5

Data and Summary Statistics

5.1. Data Selection

The sample consists of firm-quarters between 1984 and 1994 inclusive, meeting the following requirements:

1. The firm has a December 31 fiscal year end.
2. The quarter is an interim quarter.
3. Interim earnings announcement date and prior quarter closing stock price are available on the quarterly COMPUSTAT Primary, Supplementary and Tertiary (PST) files.
4. At least five analysts' annual earnings forecasts of the firm during the forty five days before the quarterly earnings announcement date, and the revised forecasts from the ***same*** analysts during the thirty days after the announcement are available on the detailed I/B/E/S files.
5. Actual quarterly earnings and at least one quarterly earnings forecast released during the 45 days before the quarterly earnings announcement date is available on the detailed I/B/E/S files.

Only the first three interim announcements are examined because the fourth quarter announcements are equivalent to annual earnings announcements. The quarterly earnings announcement dates are used to identify the pre- and post-announcement periods. The previous quarter's closing price is used as a deflator. At least five forecasts are required to ensure that my estimates of forecast dispersion and forecast jumbling are reasonably precise.[6] To mitigate the influence of extreme values, the top 1% extreme value of earnings surprise, average forecast revision, post-announcement forecast dispersion and pre-announcement forecast dispersion (0.5% largest and 0.5% smallest) are excluded.

5.2. Summary Statistics

Panel A of Table 1 shows the descriptive statistics of the variables of the pooled sample, which contains 1,467 observations. Three observations have identical forecasts in the post-announcement period, resulting in a missing value for the variable Jumbling and reducing the observations for Jumbling to 1,464.

The average surprise contained in the interim earnings announcements is negative (-0.0020) and statistically significant at 1% confidence level. This suggests that on average, the analysts' interim earnings forecasts are higher than actual earnings and is consistent with the findings of previous studies (e.g., O'Brien 1988 and Basu et al. 1997) that analysts' quarterly earnings forecasts

[6] Using at least five observations is consistent with Barron (1995) and Bamber et al. (1997). Since the number of revisions is positively related to analyst-following, and analyst-following is positively related to the firm size, imposing such a requirement will result in a sample consisting of mainly large firms.

are optimistically biased[7]. The mean average forecast revision is also negative (-0.0035) and almost twice the magnitude of the surprise, suggesting an association between earnings surprises and analysts' forecast revisions.

The mean of annual earnings forecast dispersion around the interim announcements reduces almost by half from 0.0114 to 0.0062. The negative and significant average change in analysts' annual earnings forecast dispersion, -0.0052, indicates that analysts' annual earnings forecasts converge around the interim earnings announcements. This is consistent with the results of Brown and Han (1992) that on average, analysts' annual earnings forecast dispersion is reduced after an interim earnings announcement.

The average forecast jumbling is 0.6823, indicating that the average correlation coefficient of pre- and post-announcement periods earnings forecasts is 0.3177. The positive correlation coefficient is consistent with the assumption of the model that pre-announcement period information is used in conjunction with the announcement period information.

Panels B through D of Table 1 show the descriptive statistics for quarter 1 through 3, respectively. The sub-samples for the first and third quarters are of

[7] Brown (1998) separates firms that report losses from firms that reports profits and shows that analysts' forecasts are optimistically biased for loss firms and pessimistically biased for profit firms.

similar size (563 and 549, respectively), but the sub-sample for the second quarter is much smaller (355), a little over 60% of those of the first and third quarters. As the year progresses, the quarterly earnings forecasts become more and more biased and the mean forecast error changes from -0.0007 in the first quarter to -0.0031 in the third quarter, more than quadrupling in magnitude. The ratio of analysts' average forecast revisions to interim earnings surprise decreases from more than 2 to a little over 1.5, consistent with the model's prediction that as the year progresses, the association between analysts' average forecast revision and interim earnings surprise weakens.

As the year progresses, both the pre- and the post-announcement periods forecast dispersion decreases, suggesting that as the forecast horizon shortens and more information about the annual earnings becomes available, the disagreement among analysts decreases. The change in analysts' forecast dispersion is the largest in absolute value for the first quarter, reduces by one third for the second quarter, and recovers half of the loss by the third quarter. I argue that analysts' forecasts converge the most around the first quarter announcements because the information about annual earnings is sparse and of low precision early in the year (large forecast dispersion before the announcements). More information becomes available by the second quarter (reduced forecast dispersion before the second quarter earnings announcements) so the second quarter earnings announcements do not elicit strong reactions (fewer forecast revisions) and have less impact on forecast convergence. Because of the short forecast horizon of the third quarter, the impact of the third interim earnings announcements increases (greater number of forecast revisions) despite more information being available (yet smaller forecast dispersion before the third quarter earnings announcements). Thus, we observe an increased forecast convergence around earnings announcements. Forecast jumbling shows a similar pattern over the quarters, that is, relative more reliance on interim earnings (more jumbling) for the first and the third quarters and relatively more reliance on pre-announcement period information (less jumbling) for the second quarter.

Table 2 presents summary information of the number on the days between interim earnings announcement dates and analysts' forecast revision dates. Over 20% of all analysts revise their annual earnings forecasts within 10 days after the interim earnings announcements, and over 50% of all analysts revise their forecasts within 30 days. Only about 17% of all analysts revise their forecasts within the 30-day period beginning one month after the earnings announcements, and about 12% of all analysts revise their forecasts within the 30-day period beginning two months after the earnings announcements. This means that in the month following interim announcements, the number of analysts who revise their future forecasts is about three times higher than in other months. My findings are consistent with Stickel's (1989) that a concentration of forecast revisions immediately follows interim earnings announcements.

In Table 3, I compare the change in analysts' future earnings forecast dispersion around interim earnings announcements with those between non-announcement periods. Panel A of Table 3 shows that forecast revisions occur both around interim earnings announcements and in non-announcement periods (about 20% more in announcement period then in non-announcement periods). Also, analysts' forecast dispersion decreases both around interim earnings announcements and in non-announcement periods, suggesting that both interim announcements and other information resolve uncertainty among analysts. Panel B of Table 3 shows that while annual earnings forecasts convergence does not differ in the two non-announcement periods, the annual earnings forecasts converge more around interim announcements. This suggests that although analysts receive information relevant to future earnings forecasts throughout the year, public information such as earnings resolves more uncertainty among analysts than other information.

Table 4 compares analysts' forecast jumbling around interim announcements and between the two non-announcement periods. Panel A of Table 4 shows that forecast revisions and forecast jumbling exist both around the interim announcements and between non-announcement periods, although both measures appear higher in announcement periods. Panel B of Table 4 shows that while the difference between forecast jumbling in non-announcement periods is insignificant, the difference between announcement period and non-announcement periods is significant. In sum, the public information such as interim earnings appears to have greater impact on analysts' annual earnings forecast revisions than other information in general.

Chapter 6

Test Results

Tables 5 through 7 show the regression test results of the hypotheses. In each table, the results of the hypotheses using the three proxies for earnings precision are shown separately in Panel A through C. In each panel, the results of each of the three interim quarters in each year are also shown separately.

6.1. Tests on Average Forecast Revision (H1)

Earnings precision in Panel A of Table 5 is based on whether the interim surprise is extreme. Compared to the adjusted R^2 in the Abdel-Khalik (1983) study, the first two quarters' adjusted R^2's (6.19% and 4.62%) are about half the magnitude and the third quarter's (13.67%) is comparable. The sum of the coefficient on surprise and that on interactive term of surprise and precision, $\beta+\gamma$, is positive and significant at 1% level for all quarters. This means that analysts' average forecast revisions are positively associated with earnings surprise when earnings precision is high. The average magnitude of $\beta+\gamma$ is comparable to the coefficient on forecast error in the Abdel-Khalik (1983) study, but the nature of descending by quarters is more salient. The coefficient on the interactive term of surprise and precision, γ, is positive and significant at the 1% confidence level for all three interim quarters. This suggests that the association between the average forecast revisions and the interim earnings surprise is stronger when interim earnings are more precise. The coefficient of surprise, β, is positive but statistically insignificant for the first quarter and negative and significant at the 1% level for the second and third quarters. This suggests that analysts are not responsive to less precise earnings surprise in the first quarter and expect it to reverse in the second and third quarters. In sum, the results in Panel A in Table 5 support Hypothesis 1 that the average forecast revisions are positively associated with the earnings surprise when earnings precision is high and the association is strong for the earlier quarters in each year. Analysts are less responsive to earnings surprise or expect them to be reversed later when earnings precision is low.

In Panel B of Table 5, the earnings precision is based on whether interim earnings show a net profit or a net loss. In Panel C of Table 5, the earnings precision is based on whether the interim earnings contain extraordinary items. The results presented in these two panels are weaker than the results in Panel A of Table 5. The coefficient of interactive term of surprise and precision, γ, is positive, as predicted, for five of the six quarters but significant at the 1% level for only three of the six quarters. The sum of the coefficient on surprise and the interactive term of surprise and precision is positive as predicted for only four of the six quarters and positive and significant at the 1% level for only three of the six quarters. An alternative explanation is that the second and third proxies for earnings precision are poor ones.

Although the adjusted R^2 Panel A through C of Table 5 are smaller for the first two interim quarters than those in previous studies, they are quite stable across models. Overall, the adjusted R^2 are slightly higher for the first model, which could be another indication that the first proxy for earnings precision is a better measure.

6.2. Tests on Change in Forecast Dispersion (H2)

Table 6 shows the test results of the relationship between the change in analysts' forecast dispersion and interim earnings (Hypothesis 2).

In Panel A of Table 6, earnings precision is based on whether the interim surprise is extreme. The adjusted R^2 of the regression ranges from 41.62% to 51.10%. The coefficient on the absolute value of earnings surprise, β, is positive, as predicted, and significant at the 1% confidence level for all quarters. β has similar values for the first and the second quarters but decreases about 20% in the third quarter. This suggests that as the year approaches its end, the difference between analysts' interpretation of earnings surprise with high versus low precision decreases.

The coefficient on earnings precision, γ, is negative as predicted and statistically significant at the 1% confidence level for the first and third quarters and positive but not significant for the second quarter. This means that, on average, analysts' forecast dispersion decreases about 0.0025 and 0.0030 for the first and third quarters, respectively, more for earnings of high precision than when earnings are of low precision. The magnitudes of the coefficient are about 50% of the average change in forecast dispersion for each quarter (see Table 1). The trend of γ shows that the change in analysts' forecast dispersion is affected more by earnings precision for the first and third quarter and less for the second quarter. As argued before, in the first quarter, earnings are more important because less information is available. In the second quarter, since more information becomes available as the year progresses, the earnings become less important. In the third quarter, earnings become important again because the fiscal year end is near. Consistently, I also found a relatively larger coefficient on pre-announcement dispersion, λ, for the second quarter, indicating that in the second quarter, post-announcement analysts' forecast dispersion is more strongly influenced by pre-announcement analysts' forecast dispersion.

In sum, the regression results support Hypothesis 2 that the change in analysts forecast dispersion is positively associated with the absolute value of earnings surprise, negatively associated with the earnings precision, and positively associated with pre-announcement forecast dispersion. The regression coefficients vary across different quarters in the year.

Panel B and C of Table 6 present the results of regressions that use the earnings precision measures that are based on whether interim earnings show profit or loss and whether the interim earnings contain extraordinary items, respectively. The results in these two panels are similar to those in Panel A except that the coefficient on precision is negative as predicted and statistically significant for only half the times. This is consistent with the finding of the previous section that the last two proxies for earning precision do not produce strong supporting evidence.

6.3. Tests on Forecast Jumbling (H3)

The results of the analysts' annual earnings forecast jumbling around the interim earnings announcements are presented in Table 7. In general, the results are very weak. The largest adjusted R^2 is barely 1.33% and one is negative. None of the coefficients on the absolute value of surprise and precision are of predicted sign and statistically significant. The coefficient on pre-announcement forecast dispersion is positive as predicted for all regressions and significant at 10% or higher level for seven of nine times. The intercept is close to the average value of jumbling for all regressions (see Table 1). It is reasonable to conclude, therefore, that the surprise and the precision of interim earnings, as measured in this study, do not explain much of the variation in the analysts' annual forecast jumbling around the interim announcements. Therefore, the results do not support the predictions of Hypothesis 3.

Chapter 7

The Tests of Robustness

7.1. Alternative Measure of Jumbling

In the literature of forecast jumbling study, alternative jumbling measures based on non-parametric correlation coefficient such as Pearson correlation and Spearman rank correlation are often used. Using either Pearson correlation or Spearman rank correlation to measure analysts' forecast jumbling produces almost identical results to simple correlation measure. The results of using Pearson correlation to measure forecast jumbling are presented in Table 8.

7.2. Alternative Deflators

As shown in Christie (1987), to avoid specification errors in cross-sectional 'level' studies, the deflator should be a function of independent variables. A natural choice, therefore, should be mean forecast. However, using mean forecast can cause the results to be influenced by small values in the deflator. The deflator used in the main tests, previous period stock price, is less subject to the problem of small values in the deflator. To test the robustness of my deflator, I conducted test using the observations with previous period closing price no less then $10.00 only and find qualitatively similar results (see Table 9). I also use the total assets as deflator and also find qualitatively similar results (see Table 10).

7.3. Alternative Cut-off Lines for Extreme Surprise

In the main testing, an arbitrary 10% is chosen as the cut-off line to differentiate extreme earnings surprise from non-extreme earnings surprise. To examine how sensitive the results are to this 10% cut-off line, cut-off lines of 15% and 20% are also used and yield qualitatively similar results. The results using 15% as cut-off line are presented in Table 11.

7.4. Separating the Extreme Positive and Negative Surprise

Some researchers suggest that analysts may react differently to "good news" and "bad news" in earnings. For instance, Bricker and Grant (1997) argue and show that analysts' incentives to produce a favourable report may dominate the incentives to produce an informative report particularly when a company's performance is below the expectations. Therefore, analysts should be less responsive to "bad news" or losses included in earnings. On other hand, Basu et al. (1998) and Mendenhall and Nichols (1988) argue and show that since managers have more discretion not to report "bad news" in interim earnings, the "bad news" or losses they do report tend to be more persistent and less reversible and result in stronger reactions. Similar to Basu et al. (1997) partition of positive and negative special items, I conduct additional tests by separating low precision group (firms report extraordinary items) into two groups: firms with positive extreme earnings surprise and firms with negative extreme earnings surprise to see whether analysts react to them differently. To do so, I use two dummy variables, D^1 and D^2.

D^1 = *1 if there is positive extraordinary item or positive extreme surprise, 0 otherwise;*

D^2 = *1 if there is negative extraordinary item or negative extreme surprise, 0 otherwise.*

The regressions (R1), (R2') and (R3) and predicted signs of the regression coefficients therefore become

$$\underset{}{AvgRev} = \alpha + \underset{(+)}{\beta}(UX) + \underset{(-)}{\gamma^1}(UX * D^1) + \underset{(-)}{\gamma^1}(UX * D^1) + \varepsilon \qquad (R1A)$$

$$PostDisp = \alpha + \underset{(+)}{\beta}|UX| + \underset{(+)}{\gamma^1} D^1 + \underset{(+)}{\gamma^1} D^1 + \underset{(+)}{\lambda} PreDisp + \varepsilon \qquad (R2A)$$

$$Jumb = \alpha + \underset{(+)}{\beta}|UX| + \underset{(-)}{\gamma^1} D^1 + \underset{(-)}{\gamma^1} D^1 + \underset{(+)}{\lambda} PreDisp + \varepsilon \qquad (R3A)$$

The OLS regression results are shown in Table 12. Comparison of Panel A in Table 12 and Panel A in Table 5 shows that adjusted R^2's in Table 12 are larger. This suggests that separating the low precision group into groups with positive extreme earnings surprise and negative earnings surprise increases the model's explanatory power. The coefficient on earnings surprise, β, is positive, as predicted, and significant at 1% level and in descending order. The coefficient on the interactive term of surprise and low precision group with negative extreme surprise, γ^2, is negative and significant at 1% level for all quarters. In contrast, the coefficient on the interactive term of surprise and the low precision group with positive extreme surprise, γ^1, is mixed, that is, negative and significant at 10% and 5% levels for the first and the third quarters, respectively, and positive and significant at 1% for the second quarter. The results suggest that negative extreme earnings surprise is a better measure of low earnings precision than is positive extreme surprise.

Comparison of Panel B of Table 12 and Panel A of Table 6 shows similar regularities. The coefficients on the absolute value of surprise, β, and on pre-announcement forecast dispersion, λ, in Panel B of Table 12 are not qualitatively different from those in Panel A of Table 6. The coefficient on the low earnings precision group with negative extreme surprise, γ^2, is positive, as predicted, for all quarters and significant at 1% level for the first and third quarters. The coefficient on the low earnings precision group with positive extreme surprise, γ^1, however, is significant at 1% level but has wrong sign for the first quarter and not significant for the second and the third quarters. This again suggests that negative extreme surprise is a better measure of low precision than positive extreme surprise is.

Like Panel A of Table 7, Panel C of Table 12 shows no systematic relationship between analysts' forecast jumbling and the measure of interim earnings.

Chapter 8

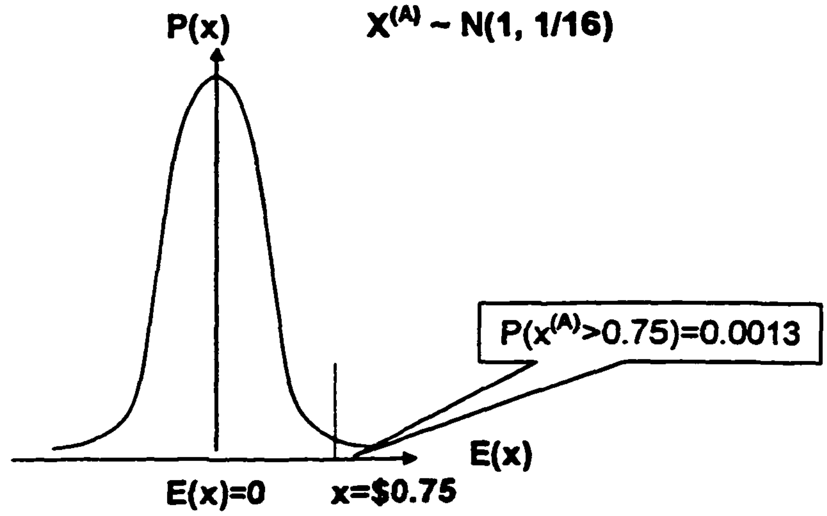
Conclusion

This study examines how the interim earnings announcements affect analysts' annual earnings forecast revisions around the announcements. The properties of interim earnings examined are surprise and precision; the properties of analysts' forecast revisions examined are average forecast revisions, change in forecast dispersion, and forecast jumbling. The study first develops an analytical model that examines the relationship between interim earnings announcement and analysts annual earning forecast revisions. The analytical model developed in this study paper predicts the following: (1) Analysts' annual earnings forecast revisions are positively associated with the surprise in interim earnings. The association is stronger when the precision of interim earnings is higher. As the year progresses, the impact of earnings surprise weakens. (2) The change of analysts' forecast dispersion is positively associated with the absolute value of the surprise and negatively associated with the precision of interim earnings and pre-announcement information precision. (3) Analysts' annual earnings forecast jumbling is positively associated with the surprise in interim earnings and pre-announcement information precision, and negatively associated with interim earnings precision. The study then empirically tests these hypotheses. The empirical evidence is consistent with the predictions of the first two hypotheses but too weak to lend any support to the third hypothesis. In addition, this study produced the following results. (a) On average, annual earnings forecasts converge after interim earnings announcements and analysts' forecast jumbling increases around the interim earnings announcements. The increased jumbling, however, cannot be explained by the properties of interim earnings as measured in this study. (b) Whether earnings surprise is extreme is a better measure of earnings precision than whether earnings contain extraordinary item or whether earnings show a profit or loss. (c) The impact of earnings precision on the change of analysts' forecast dispersion is stronger when low earnings precision is measured by negative extreme surprise than by positive extreme surprise.

Figure 1

The interactive relationship between the surprise and the precision of earnings

Panel A. Higher Earnings Precision



Panel B. Lower Earnings Precision

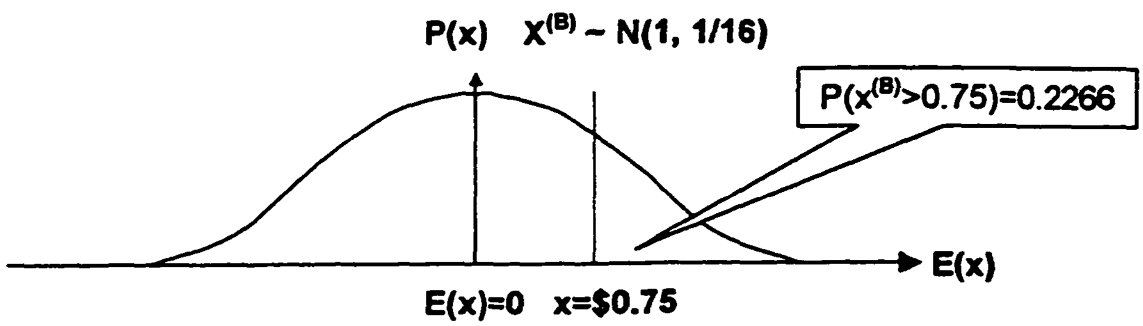
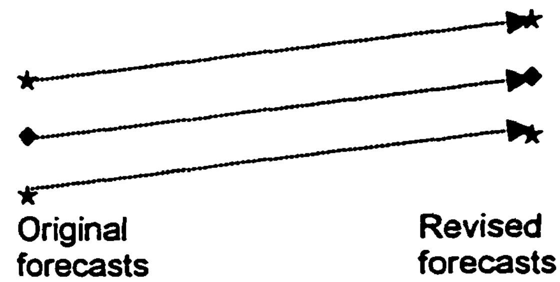


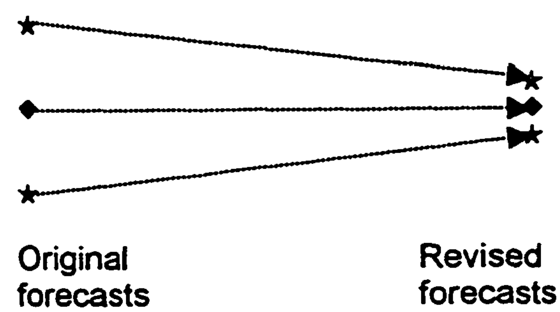
Figure 2

The complementary relationship among the average forecast revision, change in forecast dispersion, and forecast jumbling

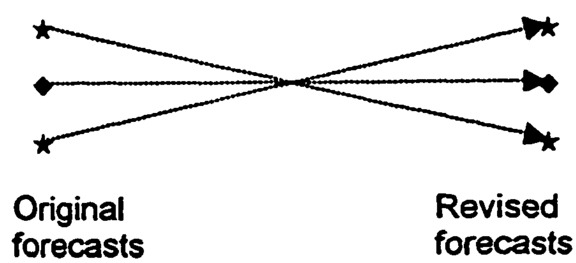
Panel A. Change Only in Average Revision



Panel B. Change Only in Forecast Dispersion



Panel C. Forecast Jumbling Only

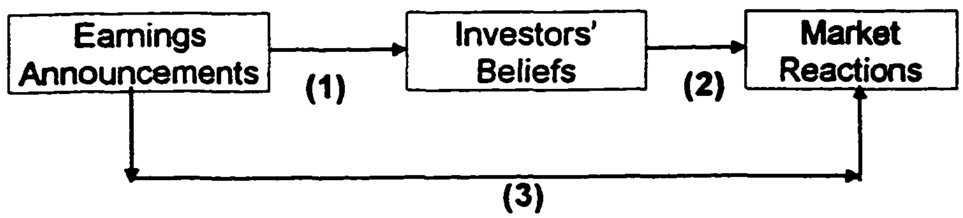


◆: Average forecast
★: Individual forecast

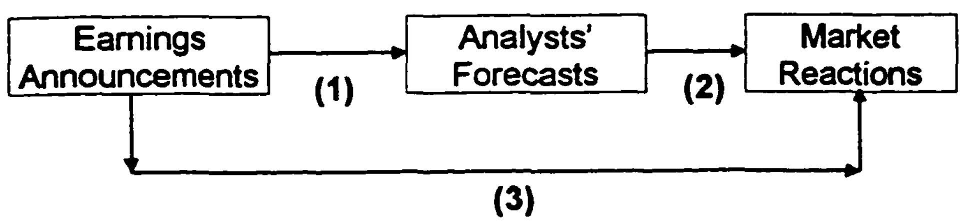
Figure 3

The framework of market-oriented earnings information content research

Panel A. The Relationship among Earnings, Investors' Beliefs, and Market Reactions



Panel B. The Relationship among Earnings, Analysts' Forecasts, and Market Reactions



Appendix

Summary of Variable Definition

1. Average Forecast Revision ($AvgRev_{iqt}$)

$$AvgRev_{iqt} = \{\Sigma_j[F_{jq+}(y_{it})-F_{jq-}(y_{it})]\}/(m_{iqt}P_{iq-1})$$

Where

x_{it}: firm i's earnings per share in year t

P_{iq-1}: firm i's period q-1 closing stock price

m_{iqt}: number of qualified forecast revisions for firm i, quarter q in year t

$F_{jq+}(.)$: analyst j's forecast released in the period of 30 days after quarter q's earnings announcement (from detailed I/B/E/S files)

$F_{jq-}(.)$: analyst j's forecast released in the period of 45 days before quarter q's earnings announcement (from detailed I/B/E/S files)

2. Change in Forecast Dispersion ($\Delta Disp_{iqt}$)

$$\Delta Disp_{iqt} = PostDisp_{iqt} - PreDisp_{iqt}$$

Where

$PostDisp_{iqt}$: $\{\Sigma_j[F_{jq+}(y_{it})-F_{q+}(y_{it})]^2/(m_{iqt}-1)\}^{(1/2)}/(P_{iq-1})$

$PreDisp_{iqt}$: $\{\Sigma_j[F_{jq-}(y_{it})-F_{q-}(y_{it})]^2/(m_{iqt}-1)\}^{(1/2)}/(P_{iq-1})$

$F_{q+}(.)$: $\Sigma_j F_{jq+}(.)/m_{iqt}$

$F_{q-}(.)$: $\Sigma_j F_{jq-}(.)/m_{iqt}$

3. Forecast Jumbling ($Jumb_{iqt}$)

$Jumb_{iqt}$: $1-\Sigma_j[(F_{jq+}(y_{it})-F_{q+}(y_{it})][F_{jq-}(y_{it})-F_{q-}(y_{it})]/\{\Sigma_j[F_{jq+}(y_{it})-F_{q+}(y_{it})]^2\Sigma_j[F_{jq-}(y_{it})-F_{q-}(y_{it})]^2\}^{1/2}$

All functions and variables are same as in above.

Appendix (continued)

Summary of Variable Definition

4. Earnings Surprise (UX_{iqt})

$UX_{iqt} = [\check{z}_{iqt} - F(z_{iqt})]/P_{iq-1}$

Where

x: actual earnings

F(.): analysts' average quarterly earnings forecasts.

5. Earnings Precision (D_{iqt})

5.1. Based on whether earnings surprise is extreme

D_{iqt} = 1 if the absolute value of the earnings surprise firm I, quarter q in year t is in the bottom 90%; 0 otherwise.

5.2. Based on whether there is profit or loss

D_{iqt} = 1 if firm i reports profit in quarter q in year t; 0 otherwise.

5.3. Based on whether there are extraordinary items in earnings

D_{iqt} = 1 if firm I reports no extraordinary item in quarter q year t; 0 otherwise.

Table 1

The Descriptive Statistics of the Variables*

Panel A. The descriptive statistics of the pooled sample

Variable	N	Mean	Std. Dev.	T-statistics
Ux_{iqt}	1467	-0.0020	0.0106	-7.0797***
$AvgRev_{iqt}$	1467	-0.0035	0.0147	-8.9979***
$\Delta Disp_{iqt}$	1467	-0.0052	0.0431	-15.3403***
$PostDisp_{iqt}$	1467	0.0062	0.0087	27.3969***
$PreDisp_{iqt}$	1467	0.0114	0.0159	27.5626***
$Jumb_{iqt}$	1464	0.6823	0.4381	27.7399***

Panel B. The descriptive statistics of the first quarter sample

Variable	N	Mean	Std. Dev.	T-statistics
UX_{iqt}	563	-0.0007	0.0076	-2.2273**
$AvgRev_{iqt}$	563	-0.0015	0.0167	-2.1102**
$\Delta Disp_{iqt}$	563	-0.0061	0.0129	-11.2420***
$PostDisp_{iqt}$	563	0.0070	0.0083	19.9711***
$PreDisp_{iqt}$	563	0.0131	0.0160	19.3577***
$Jumb_{iqt}$	563	0.7075	0.4506	15.4034***

Panel C. The descriptive statistics of the second quarter sample

Variable	N	Mean	Std. Dev.	T-statistics
UX_{iqt}	355	-0.0022	0.0089	-4.6498***
$AvgRev_{iqt}$	355	-0.0043	0.0134	-5.9672***
$\Delta Disp_{iqt}$	355	-0.0041	0.0126	-6.1430***
$PostDisp_{iqt}$	355	0.0066	0.0095	13.0888***
$PreDisp_{iqt}$	355	0.0107	0.0158	12.7747***
$Jumb_{iqt}$	352	0.6450	0.4346	15.3259***

Table 1 (continued)

The Descriptive Statistics of the Variables

Panel D. The descriptive statistics of the third quarter sample

Variable	N	Mean	Std. Dev.	T-statistics
UX_{iqt}	549	-0.0031	0.0138	-5.2823***
$AvgRev_{iqt}$	549	-0.0050	0.0130	-8.9132***
$\Delta Disp_{iqt}$	549	-0.0051	0.0135	-8.7874***
$PostDisp_{iqt}$	549	0.0051	0.0084	15.3821***
$PreDisp_{iqt}$	549	0.0102	0.0157	15.2600***
$Jumb_{iqt}$	549	0.6806	0.4263	17.5583***

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.

UX_{iqt}: The surprise in interim earnings announcements deflated by stock price at the beginning of the period.

$AvgRev_{iqt}$ Average earnings forecast revision around interim earnings announcements deflated by stock price at the beginning of the period.

$PostDisp_{iqt}$: Annual earnings forecast dispersion after interim earnings announcements deflated by stock price at the beginning of the period.

$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.

$Jumb_{iqt}$: 1- Correlation coefficient of analysts' forecast of before and after interim announcements.

*** See Appendix for the detailed definitions of the variables.**

Table 2

Number of Days between Interim Earnings Announcement Date and Analysts' Forecast Revision Date

Panel A. Breakdown of First Month after Announcements

Number of days	1~10	11~20	21~30	Total
Total	34895	28617	22658	168356
%	20.73%	17.00%	13.46%	100.0%

Panel B. Breakdown of First Three Months after Announcements

Number of days	0~30	31~60	61~90	>90	Total
Total	86170	29466	20085	32635	168356
%	51.18%	17.50%	11.93%	19.38%	100.0%

Table 3

Change in Forecast Dispersion in the Earnings Announcement Period and Non-Announcement Periods

Panel A. The Average Change in Forecast Dispersion around the earnings announcements and non-announcement periods

	Announcement Period	Non-announcement Periods	
	Period 1	Period 2	Period 3
Period of Original Forecast	-30~-1	0~30	31~60
Period of Revision	0~30	31~60	61~90
ΔDisp	-0.0064	-0.0020	-0.0024
# of observations	3233	2676	2352

Panel B. The Comparison of Change in Forecast Dispersion around the earnings announcements and non-announcement periods

	Comparison of announcement Period vs. Non-announcement period		Comparison between non-announcement periods
	Period 1 vs. Period 2	Period 1 vs. Period 3	Period 2 vs. Period 3
Difference in ΔDisp	-0.0044	-0.0040	0.0004
(T-statistics)	-1.823**	-1.616*	-0.774

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$\Delta Disp_{iqt}$: Changes in annual earnings forecast dispersion around interim earnings announcements deflated by the stock price at the beginning of the period.

See Appendix for the definitions of the variables.

Table 4

Forecast Jumbling in the Earnings Announcement Period and Non-Announcement Periods

Penal A. The Change in Forecast Dispersion and Forecast Jumbling around the earnings announcements and non-announcement periods

	Announcement period	Non-announcement Periods	
	Period 1	Period 2	Period 3
Period of Original Forecast	-30~-1	0~30	31~60
Period of Revision	0~30	31~60	61~90
Jumb	0.6907	0.6321	0.6159
# of observations	1524	1117	817

Panel B. Comparison of Forecast Jumbling around the earnings announcements and non-announcement periods

	Comparison of announcement Period vs. Non-announcement period		Comparison between non-announcement periods
	Period 1 vs. Period 2	Period 1 vs. Period 3	Period 2 vs. Period 3
Difference in Jumb	0.0586	0.0748	0.0162
(T-statistics)	2.292***	3.315***	0.772

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$Jumb_{iqt}$: Forecast jumbling around interim earnings announcements.

See Appendix for the detailed definitions of the variables.

Table 5

The Test Results about Average Forecast Revisions

Regression: $AvgRev_{iqt} = \alpha + \beta UX_{iqt} + \gamma D_{iqt} UX_{iqt} + \varepsilon_{iqt}$

Panel A. Earnings precision is based on whether earnings surprise is extreme

Coefficient	α	β	γ	$\beta+\gamma$
Predicted sign	?	+, 0, or -	+	+
1st Quarter Adj-R^2=0.062	-0.0001 (-0.264)	0.1214 (1.5924)	0.7488 (4.596)***	0.8702 P=0.0001
2nd Quarter Adj-R^2=0.046	-0.0017 (-2.711)***	-0.2495 (-3.142)***	0.7157 (4.084)***	0.4662 P=0.0035
3rd Quarter Adj-R^2=0.137	-0.0023 (-4.802)***	-0.4029 (-9.232)***	0.5260 (4.237)***	0.1231 P=0.2988

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$AvgRev_{iqt}$: Average earnings forecast revision around interim earnings announcements deflated by stock price at the beginning of the period.

UX_{iqt}: The surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if the absolute value of surprise in interim earnings is in the bottom 90%, 0 otherwise.

See Appendix for the detailed definitions of the variables.

Table 5 (continued)

The Test Results about Average Forecast Revisions

Regression: $AvgRev_{iqt} = \alpha + \beta UX_{iqt} + \gamma D_{iqt} UX_{iqt} + \varepsilon_{iqt}$

Panel B. Earnings precision is based on whether there is profit or loss

Coefficient	α	β	γ	$\beta+\gamma$
Predicted sign	?	+, 0 or -	+	+
1st Quarter Adj-R^2=0.029	0.0001 (0.169)	0.3591 (3.995)***	-0.2303 (-1.300)	0.1288 P=0.3496
2nd Quarter Adj-R^2=0.028	-0.0034 (-4.814)***	-0.2496 (-2.924)***	0.6920 (3.140)***	0.4424 P=0.0207
3rd Quarter Adj-R^2=0.110	-0.0029 (-5.434)***	-0.3502 (-7.595)***	0.0338 (0.194)	-0.3164 P=0.0013

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$AvgRev_{iqt}$: Average earnings forecast revision around interim earnings announcements deflated by stock price at the beginning of the period.

UX_{iqt}: The surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if there is net profit in interim earnings; 0 otherwise.

See Appendix for the detailed definitions of the variables.

Table 5 (continued)

The Test Results about Average Forecast Revisions

Regression: $AvgRev_{iqt} = \alpha + \beta UX_{iqt} + \gamma D_{iqt}UX_{iqt} + \varepsilon_{iqt}$

Panel C. Earnings precision is based on whether earnings contain extraordinary items or not

Coefficient	α	β	γ	$\beta+\gamma$
Predicted sign	?	+, 0 or -	+	+
1st Quarter Adj-R^2=0.023	-0.0004 (-0.768)	0.2397 (3.357)***	0.0679 (0.521)	0.3076 P=0.0020
2nd Quarter Adj-R^2=0.040	-0.0028 (-5.216)***	-0.3199 (-5.812)***	0.6473 (5.204)***	0.3274 P=0.0042
3rd Quarter Adj-R^2=0.197	-0.0033 (-7.130)***	-0.4597 (-13.552)***	0.2671 (2.637)***	-0.1926 P=0.1491

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$AvgRev_{iqt}$: Average earnings forecast revision around interim earnings announcements deflated by stock price at the beginning of the period.

UX_{iqt}: The surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if there is no extraordinary item in interim earnings; 0 otherwise.

See Appendix for the detailed definitions of the variables.

Table 6

The Test Results of the Change in Forecast Dispersion

Regression: $PostDisp_{iqt} = \alpha + \beta|UX_{iqt}| + \gamma D_{iqt} + \lambda PreDisp_{iqt} + \varepsilon_{iqt}$

Panel A. Earnings precision is based on whether earnings surprise is extreme

Coefficient	α	β	γ	λ
Predicted sign	?	+	-	+
1st Quarter Adj-R^2=0.416	0.0047 (3.076)***	0.3517 (5.747)***	-0.0025 (-1.728)***	0.2340 (12.902)***
2nd Quarter Adj-R^2=0.442	0.0016 (0.067)	0.3799 (4.765)***	0.0002 (0.072)	0.3064 (12.081)***
3rd Quarter Adj-R^2=0.511	0.0045 (3.726)***	0.2941 (9.856)***	-0.0030 (-2.649)***	0.1629 (10.763)***

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level

$PostDisp_{iqt}$: Annual earnings forecast dispersion after interim earnings announcements deflated by stock price at the beginning of the period.

$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.

$|UX_{iqt}|$: The absolute value of the surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if surprise in interim earnings is in the bottom 90%, 0 otherwise.

See Appendix for the detailed definitions of the variables.

Table 6 (continued)

The Test Results of the Change in Forecast Dispersion

Regression: $PostDisp_{iqt} = \alpha + \beta|UX_{iqt}| + \gamma D_{iqt} + \lambda PreDisp_{iqt} + \varepsilon_{iqt}$

Panel B. Earnings precision is based on whether there is profit or loss

Coefficient	α	β	γ	λ
Predicted sign	?	+	-	+
1st Quarter Adj-R^2=0.423	0.0030 (6.722)***	0.4153 (9.865)***	-0.0016 (-3.129)***	0.2327 (12.910)***
2nd Quarter Adj-R^2=0.442	0.0018 (3.021)***	0.3759 (6.829)***	0.0000 (0.020)	0.3065 (12.082)***
3rd Quarter Adj-R^2=0.507	0.0011 (3.420)***	0.3561 (16.392)***	0.00074 (1.709)	0.1705 (11.513)***

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$PostDisp_{iqt}$: Annual earnings forecast dispersion after interim earnings announcements deflated by stock price at the beginning of the period.

$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.

$|UX_{iqt}|$: The absolute value of the surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if there is net profit in interim earnings; 0 otherwise.

See Appendix for the detailed definitions of the variables.

Table 6 (continued)

The Test Results of the Change in Forecast Dispersion

Regression: $PostDisp_{iqt} = \alpha + \beta|UX_{iqt}| + \gamma D_{iqt} + \lambda PreDisp_{iqt} + \varepsilon_{iqt}$

Panel C. Earnings precision is based on whether there is extraordinary item or not

Coefficient	α	β	γ	λ
Predicted sign	?	+	-	+
1st Quarter Adj-R^2=0.477	0.0018 (4.841)***	0.6491 (16.732)***	-0.0005 (-0.873)	0.2143 (13.014)***
2nd Quarter Adj-R^2=0.443	0.0022 (2.239)***	0.3708 (6.704)***	-0.0095 (-1.988)*	0.3070 (12.099)***
3rd Quarter Adj-R^2=0.441	0.0020 (5.725)***	0.2777 (14.456)***	-0.0166 (-2.372)**	0.2485 (14.962)***

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$PostDisp_{iqt}$: Annual earnings forecast dispersion after interim earnings announcements deflated by stock price at the beginning of the period.

$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.

$|UX|_{iqt}$: The absolute value of the surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if there is no extraordinary item in interim earnings; 0 otherwise.

See Appendix for the detailed definitions of the variables.

Table 7

The Test Results of Forecast Jumbling

Regression: $Jumb_{iqt} = \alpha + \beta|UX_{iqt}| + \gamma D_{iqt} + \lambda PreDisp_{iqt} + \varepsilon_{iqt}$

Panel A. Earnings precision is based on whether earnings surprise is extreme

Coefficient	α	β	γ	λ
Predicted sign	?	+	+	+
1st Quarter Adj-R^2=0.006	0.6087 (5.406)***	-3.561 (-0.793)	0.0843 (0.803)	2.5923 (1.947)*
2nd Quarter Adj-R^2=-.001	0.5822 (3.957)***	-0.5378 (-0.111)	0.0397 (0.286)	2.5027 (1.627)
3rd Quarter Adj-R^2=0.009	0.4696 (4.393)***	1.6748 (0.634)	0.1880 (7.875)*	3.3107 (2.471)**

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$Jumb_{iqt}$: 1-correlation coefficient of analysts' earnings forecasts of before and after interim announcements.

$|UX_{iqt}|$: The absolute value of the surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if surprise in interim earnings is in the bottom 90%, 0 otherwise.

$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.

See Appendix for the detailed definitions of the variables.

Table 7 (continued)

The Test Results of Forecast Jumbling

Regression: $Jumb_{iqt} = \alpha + \beta|UX_{iqt}| + \gamma D_{iqt} + \lambda PreDisp_{iqt} + \varepsilon_{iqt}$

Panel B. Earnings precision is based on whether there is profit or loss

Coefficient	α	β	γ	λ
Predicted sign	?	+	+	+
1st Quarter Adj-R^2=0.006	0.6819 (20.643)***	-5.9543 (-1.915)*	0.0276 (0.725)	2.6252 (1.971)**
2nd Quarter Adj-R^2=0.013	0.6690 (18.721)***	-2.5572 (-0.772)	-0.1069 (-2.239)**	2.5391 (1.663)*
3rd Quarter Adj-R^2=0.003	0.6629 (23.908)***	-1.7408 (-0.905)	0.0060 (0.157)	2.7225 (2.077)***

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$Jumb_{iqt}$: 1-correlation coefficient of analysts' earnings forecasts of before and after interim announcements.

$|UX|_{iqt}$: The absolute value of the surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if surprise in interim earnings is in the bottom 90%, 0 otherwise.

$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.

See Appendix for the detailed definitions of the variables.

Table 7 (continued)

The Test Results of Forecast Jumbling

Regression: $Jumb_{iqt} = \alpha + \beta|UX_{iqt}| + \gamma D_{iqt} + \lambda PreDisp_{iqt} + \varepsilon_{iqt}$

Panel C. Earnings precision is based on whether there is extraordinary item or not

Coefficient	α	β	γ	λ
Predicted sign	?	+	+	+
1st Quarter Adj-R^2=0.012	0.6743 (26.999)***	-6.7039 (-2.591)***	0.0370 (1.047)	2.8699 (2.164)**
2nd Quarter Adj-R^2=0.001	0.6057 (22.407)***	2.6322 (1.227)	-0.0198 (-0.481)	1.0274 (0.794)
3rd Quarter Adj-R^2=0.002	0.6512 (27.996)***	-0.3213 (-0.248)	0.0104 (0.294)	2.2685 (2.023)**

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$Jumb_{iqt}$: 1-correlation coefficient of analysts' earnings forecasts of before and after interim announcements.

$|UX_{iqt}|$: The absolute value of the surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if there is no extraordinary item in interim earnings; 0 otherwise.

$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.

See Appendix for the detailed definitions of the variables.

Table 8. A Test of Robustness

Forecast Jumbling is based on Pearson correlation

Regression: $Jumb_{iqt} = \alpha + \beta|UX_{iqt}| + \gamma D_{iqt} + \lambda PreDisp_{iqt} + \varepsilon_{iqt}$

Coefficient	α	β	γ	λ
Predicted sign	?	+	+	+
1st Quarter Adj-R^2=0.013	0.6633 (7.157)***	-6.270 (-1.710)*	0.0.021 (0.242)	2.9843 (2.933)**
2nd Quarter Adj-R^2=0.010	0.4099 (3.932)***	7.4611 (2.140)**	0.1836 (1.869)*	1.6458 (1.328)
3rd Quarter Adj-R^2=0.007	0.5182 (6.490)***	1.2770 (0.759)	0.1284 (1.700)*	3.2918 (2.628)***

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$Jumb_{iqt}$: 1-Pearson correlation of analysts' earnings forecasts of before and after interim announcements.

$|UX_{iqt}|$: The absolute value of the surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if surprise in interim earnings is in the bottom 90%, 0 otherwise.

$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.

See Appendix for the detailed definitions of the variables.

Table 9. A Test of Robustness

Deflator is Stock Price > $10 Only

Panel A. Average Forecast Revisions

Regression: $AvgRev_{iqt} = \alpha + \beta UX_{iqt} + \gamma D_{iqt}UX_{iqt} + \varepsilon_{iqt}$

Coefficient	α	β	γ	$\beta+\gamma$
Predicted sign	?	+, 0, or -	+	+
1st Quarter Adj-R^2=0.020	-0.0001 (-0.112)	0.2013 (3.203)***	0.3461 (1.539)	0.5474 P=0.0116
2nd Quarter Adj-R^2=0.023	-0.0019 (-3.373)***	-0.1434 (-2.457)**	0.7079 (3.236)***	0.5645 P=0.0086
3rd Quarter Adj-R^2=0.224	-0.0024 (-5.339)***	-0.4547 (-14.731)***	0.5785 (3.532)***	0.1243 P=0.4464

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$AvgRev_{iqt}$: Average earnings forecast revision around interim earnings announcements deflated by stock price at the beginning of the period.

UX_{iqt}: The surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if surprise in interim earnings is in the bottom 90%, 0 otherwise.

See Appendix for the detailed definitions of the variables.

Table 9. A Test of Robustness (continued)

Deflator is Stock Price > $10 Only

Panel B. Change in Forecast dispersion

Regression: $PostDisp_{Iqt} = \alpha + \beta|UX_{Iqt}| + \gamma D_{Iqt} + \lambda PreDisp_{Iqt} + \varepsilon_{Iqt}$

Coefficient	α	β	γ	λ
Predicted sign	?	+	-	+
1[st] Quarter Adj-R^2=0.456	0.0047 (5.005)***	0.4688 (9.289)***	-0.0025 (-2.877)***	0.2001 (12.815)***
2[nd] Quarter Adj-R^2=0.405	0.0049 (1.237)***	0.2034 (3.750)***	-0.0028 (-2.469)**	0.2858 (13.419)***
3[rd] Quarter Adj-R^2=0.466	0.0033 (4.977)***	0.2408 (12.611)***	-0.0017 (-2.701)***	0.2151 (13.647)***

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$PostDisp_{iqt}$: Annual earnings forecast dispersion after interim earnings announcements deflated by stock price at the beginning of the period.

$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.

$|UX_{iqt}|$: The absolute value of the surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if surprise in interim earnings is in the bottom 90%, 0 otherwise.

See Appendix for the detailed definition of the variables.

Table 9. A Test of Robustness (continued)

Deflator is Stock Price > $10 Only

Panel C. Forecast Jumbling

Regression: $Jumb_{iqt} = \alpha + \beta|UX_{iqt}| + \gamma D_{iqt} + \lambda PreDisp_{iqt} + \varepsilon_{iqt}$

Coefficient	α	β	γ	λ
Predicted sign	?	+	+	+
1st Quarter Adj-R^2=0.015	0.6074 (10.006)***	-3.9401 (-1.196)	0.0787 (1.372)	3.0857 (3.028)***
2nd Quarter Adj-R^2=0.004	0.5754 (8.476)***	3.6148 (1.139)	0.0246 (0.376)	1.6484 (1.323)
3rd Quarter Adj-R^2=0.006	0.5759 (10.968)***	0.6715 (0.440)	0.0770 (1.520)*	3.2751 (2.605)***

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$Jumb_{iqt}$: 1-correlation coefficient of analysts' earnings forecasts of before and after interim announcements.

$|UX_{iqt}|$: The absolute value of the surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if surprise in interim earnings is in the bottom 90%, 0 otherwise.

$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.

See Appendix for the detailed definitions of the variables.

Table 10. A Test of Robustness

Deflator is Total Assets

Panel A. Average Forecast Revisions

Regression: $AvgRev_{iqt} = \alpha + \beta UX_{iqt} + \gamma D_{iqt}UX_{iqt} + \varepsilon_{iqt}$

Coefficient	α	β	γ	$\beta+\gamma$
Predicted sign	?	+, 0, or -	+	+
1st Quarter Adj-R^2=0.024	-0.0001 (-0.130)	0.1289 (1.694)*	0.4007 (2.654)***	0.5295 P=0.0001
2nd Quarter Adj-R^2=0.056	-0.0020 (-3.734)***	-0.2875 (-5.305)***	0.5739 (4.094)***	0.2864 P=0.0293
3rd Quarter Adj-R^2=0.272	-0.0022 (-5.039)***	-0.5059 (-16.312)***	0.7271 (6.706)***	0.2212 P=0.0358

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$AvgRev_{iqt}$: Average earnings forecast revision around interim earnings announcements deflated by stock price at the beginning of the period.

UX_{iqt}: The surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if surprise in interim earnings is in the bottom 90%, 0 otherwise.

See Appendix for the detailed definitions of the variables.

Table 10. A Test of Robustness (continued)

Deflator is Total Assets

Panel B. Change in Forecast dispersion

Regression: $PostDisp_{iqt} = \alpha + \beta|UX_{iqt}| + \gamma D_{iqt} + \lambda PreDisp_{iqt} + \varepsilon_{iqt}$

Coefficient	α	β	γ	λ
Predicted sign	?	+	-	+
1st Quarter Adj-R^2=0.440	0.0005 (0.414)	0.5986 (9.443)***	0.0013 (1.167)	0.2158 (13.971)***
2nd Quarter Adj-R^2=0.338	0.0054 (3.303)***	0.1518 (2.975)***	-0.0028 (-1.841)*	0.2776 (12.454)***
3rd Quarter Adj-R^2=0.472	0.0049 (4.813)***	0.2056 (9.416)***	-0.0035 (-3.660)***	0.2644 (14.992)***

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$PostDisp_{iqt}$: Annual earnings forecast dispersion after interim earnings announcements deflated by stock price at the beginning of the period.

$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.

$|UX_{iqt}|$: The absolute value of the surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if surprise in interim earnings is in the bottom 90%, 0 otherwise.

See Appendix for the detailed definitions of the variables.

Table 10. A Test of Robustness (continued)

Deflator is Total Assets

Panel C. Forecast Jumbling

Regression: $Jumb_{iqt} = \alpha + \beta|UX_{iqt}| + \gamma D_{iqt} + \lambda PreDisp_{iqt} + \varepsilon_{iqt}$

Coefficient	α	β	γ	λ
Predicted sign	?	+	+	+
1st Quarter Adj-R^2=0.020	0.7663 (7.659)***	-13.3276 (-2.579)**	-0.0811 (-0.893)	4.4313 (3.518)***
2nd Quarter Adj-R^2=0.007	0.4219 (4.245)***	7.2711 (2.332)**	0.1728 (1.840)*	0.9033 (0.663)
3rd Quarter Adj-R^2=0.004	0.5687 (7.231)***	0.5576 (0.332)	0.0805 (1.080)	3.1730 (2.340)**

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$Jumb_{iqt}$: 1-correlation coefficient of analysts' earnings forecasts of before and after interim announcements.

$|UX_{iqt}|$: The absolute value of the surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if surprise in interim earnings is in the bottom 90%, 0 otherwise.

$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.

See Appendix for the detailed definitions of the variables.

Table 11. A Test of Robustness

Extreme Surprise Cut-off Line = 15%

Panel A. Average Forecast Revisions

Regression: $AvgRev_{iqt} = \alpha + \beta UX_{iqt} + \gamma D_{iqt} UX_{iqt} + \varepsilon_{iqt}$

Coefficient	α	β	γ	$\beta+\gamma$
Predicted sign	?	+, 0, or -	+	+
1st Quarter Adj-R^2=0.028	-0.0000 (-0.024)	0.1653 (2.587)***	0.5483 (2.918)***	0.7136 P=0.0001
2nd Quarter Adj-R^2=0.026	-0.0020 (-3.436)***	-0.1609 (-2.709)***	0.6259 (3.449)***	0.4650 P=0.0078
3rd Quarter Adj-R^2=0.234	-0.0023 (-5.170)***	-0.4665 (-15.099)***	0.6427 (4.745)***	0.1762 P=0.1868

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$AvgRev_{iqt}$: Average earnings forecast revision around interim earnings announcements deflated by stock price at the beginning of the period.

UX_{iqt}: The surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if surprise in interim earnings is in the bottom 85%, 0 otherwise.

See Appendix for the detailed definitions of the variables.

Table 11. A Test of Robustness (continued)

Extreme Surprise Cut-off Line = 15%

Panel B. Change in Forecast dispersion

Regression: $PostDisp_{iqt} = \alpha + \beta|UX_{iqt}| + \gamma D_{iqt} + \lambda PreDisp_{iqt} + \varepsilon_{iqt}$

Coefficient	α	β	γ	λ
Predicted sign	?	+	-	+
1st Quarter Adj-R^2=0.450	0.0029 (2.640)***	0.5379 (10.047)***	-0.000725 (-0.710)	0.2034 (12.996)***
2nd Quarter Adj-R^2=0.405	0.0056 (3.982)***	0.1933 (3.411)***	-0.0034 (-2.489)**	0.2862 (13.441)***
3rd Quarter Adj-R^2=0.476	0.0049 (6.469)***	0.2166 (11.016)***	-0.0033 (-4.586)***	0.2095 (13.511)***

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$PostDisp_{iqt}$: Annual earnings forecast dispersion after interim earnings announcements deflated by stock price at the beginning of the period.

$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.

$|UX_{iqt}|$: The absolute value of the surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if surprise in interim earnings is in the bottom 85%, 0 otherwise.

See Appendix for the detailed definitions of the variables.

Table 11. A Test of Robustness (continued)

Extreme Surprise Cut-off Line = 15%

Panel C. Forecast Jumbling

Regression: $Jumb_{iqt} = \alpha + \beta|UX_{iqt}| + \gamma D_{iqt} + \lambda PreDisp_{iqt} + \varepsilon_{iqt}$

Coefficient	α	β	γ	λ
Predicted sign	?	+	+	+
1st Quarter Adj-R^2=0.015	0.5933 (8.314)***	-3.6271 (-1.044)	0.0906 (1.350)	2.9772 (2.929)***
2nd Quarter Adj-R^2=0.006	0.5094 (6.240)***	5.4057 (1.632)	0.0893 (1.154)	1.7073 (1.372)
3rd Quarter Adj-R^2=0.005	0.5821 (9.442)***	0.5225 (0.329)	0.0682 (1.158)*	3.1224 (2.493)***

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$Jumb_{iqt}$: 1-correlation coefficient of analysts' earnings forecasts of before and after interim announcements.

$|UX_{iqt}|$: The absolute value of the surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}: 1 if surprise in interim earnings is in the bottom 85%, 0 otherwise.

$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.

See Appendix for the detailed definitions of the variables.

Table 12. A Test of Robustness

Positive and Negative Extreme Surprises are Separated

Panel A. Average Forecast Revisions

Regression: $AvgRev_{iqt} = \alpha + \beta UX_{iqt} + \gamma^1 D_{iqt}^1 UX_{iqt} + \gamma^2 D_{iqt}^2 UX_{iqt} + \varepsilon_{iqt}$

Coefficient	α	β	γ^1	γ^2
Predicted sign	?	+	-	-
1st Quarter Adj-R^2 =0.038	0.00021 (0.462)	0.7058 (5.142)***	-0.7237 (-4.033)***	-0.5105 (3.196)***
2nd Quarter Adj-R^2 =0.050	-0.0023 (-3.961)***	0.3646 (2.850)***	-0.1744 (-0.807)	-0.6508 (-4.626)***
3rd Quarter Adj-R^2 =0.260	-0.0020 (-4.608)***	0.2381 (2.390)**	-0.7605 (-4.525)***	-0.7340 (-7.135)***

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$AvgRev_{iqt}$: Average earnings forecast revision around interim earnings announcements deflated by stock price at the beginning of the period.

UX_{iqt}: The surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}^1: 1 if surprise in interim earnings is in the top 10% and positive, 0 otherwise.

D_{iqt}^2: 1 if surprise in interim earnings is in the top 10% and negative, 0 otherwise.

See Appendix for the detailed definitions of the variables.

Table 12. A Test of Robustness (continued)

Positive and Negative Extreme Surprises are Separated

Panel B. Change in Forecast dispersion

Regression: $PostDisp_{iqt} = \alpha + \beta|UX_{iqt}| + \gamma^1 D_{iqt}^1 + \gamma^2 D_{iqt}^2 + \lambda PreDisp_{iqt} + \varepsilon_{iqt}$

Coefficient	α	β	γ^1	γ^2	λ
Predicted sign	?	+	+	+	+
1st Quarter Adj-R^2=0.451	0.0022 (6.505)***	0.5387 (9.454)***	-0.0007 (-0.460)***	0.0021 (1.194)	0.2016 (12.854)***
2nd Quarter Adj-R^2=0.401	0.0024 (5.572)***	0.1779 (2.496)**	0.0023 (1.276)	0.0053 (1.828)*	0.2911 (13.605)***
3rd Quarter Adj-R^2=0.464	0.0017 (6.599)***	0.2306 (8.865)***	0.0017 (1.635)	0.0028 (1.725)*	0.2198 (14.095)***

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$PostDisp_{iqt}$: Annual earnings forecast dispersion after interim earnings announcements deflated by stock price at the beginning of the period.
$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.
$|UX_{iqt}|$: The absolute value of the surprise in interim earnings announcements deflated by stock price at the beginning of the period.
D_{iqt}^1: 1 if surprise is in the top 10% and positive, 0 otherwise.
D_{iqt}^2: 1 if surprise is in the top 10% and negative, 0 otherwise.

See Appendix for the detailed definitions of the variables.

Table 12. A Test of Robustness (continued)

Positive and Negative Extreme Surprises are Separated

Panel C. Forecast Jumbling

Regression: $IJumb_{iqt} = \alpha + \beta|UX_{iqt}| + \gamma^1 D_{iqt}^1 + \gamma^2 D_{iqt}^2 + \lambda PreDisp_{iqt} + \varepsilon_{iqt}$

Coefficient	α	β	γ^1	γ^2	λ
Predicted sign	?	+	-	-	+
1st Quarter Adj-R^2=0.012	0.6878 (30.733)***	-8.3246 (-2.244)**	0.0231 (0.234)	0.0639 (0.571)	2.9500 (2.890)***
2nd Quarter Adj-R^2=0.019	0.5854 (23.079)***	11.5684 (2.805)***	-0.2574 (-2.515)**	-0.3968 (2.383)***	1.5651 (1.264)
3rd Quarter Adj-R^2=0.007	0.6462 (31.461)***	1.6606 (0.801)	-0.1572 (-1.886)*	-0.1588 (1.240)	3.3155 (2.666)***

***: two tailed T-test significant at 1% level.
**: two tailed T-test significant at 5% level.
*: two tailed T-test significant at 10% level.

$Jumb_{iqt}$: 1-correlation coefficient of analysts' earnings forecasts of before and after interim announcements.

$|UX_{iqt}|$: The absolute value of the surprise in interim earnings announcements deflated by stock price at the beginning of the period.

D_{iqt}^1: 1 if surprise is in the top 10% and positive, 0 otherwise.

D_{iqt}^2: 1 if surprise is in the top 10% and negative, 0 otherwise.

$PreDisp_{iqt}$: Annual earnings forecast dispersion before interim earnings announcements deflated by stock price at the beginning of the period.

See Appendix for the detailed definitions of the variables.

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IMAGE EVALUATION TEST TARGET (QA-3)

150mm

6"

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