**Seoul Journal of Business**
Volume 19, Number 2 (December 2013)

# Earnings Announcements, Analyst Forecasts, and Trading Volume*

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## Abstract

Empirical evidence shows that a significant proportion of analysts issue their forecasts at the time of an earnings announcement (Ivković and Jegadeesh 2004). These forecasts are commonly regarded as analyst interpretations of earnings news contained in the announcement (Schipper 1991). Although analytical studies suggest that market reaction to news from earnings announcement could be affected by analysts' interpretation information (Kim and Verrecchia 1994, 1997), the vast majority of previous research has ignored whether and how these analysts' interpreting forecasts affect the market reaction to the earnings announcements. Our empirical results show that sensitivity of trading volume reaction to earnings announcements is increasing in the number of announcement period analyst forecasts. The sensitivity of trading volume reaction is greater when there is small analyst forecast dispersion. We also find that stock return sensitivity is also increasing with the number of analyst forecasts. In general, our results suggests that analysts' interpretation help disseminate new information contained in earnings announcement to the market.

Keywords: earnings announcement, analyst forecast, forecast timing, stock price reaction, trading volume

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* I thank Gerald Lobo, Mary Stanford, participants in 2010 Korean Accounting Association Winter Conference and 2012 American Accounting Association Mid-year Financial Reporting Section. This work was supported by the National Research Foundation of Korea Grant funded by the Korean Government (NRF-332-2010-1-B00202).

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## 1. INTRODUCTION

Financial statements and analyst forecasts are two primary information sources available to market participants for assessing firm value. A large number of studies have examined the information content of either earnings announcements or analyst forecasts separately (see Brown [1993] and Lev [1989] for a review). However, empirical evidence shows that a significant proportion of analysts issue their forecasts at the time of an earnings announcement (Ivković and Jegadeesh 2004). These forecasts are commonly regarded as analyst interpretations of earnings news contained in the announcement (Schipper 1991). Surprisingly, the vast majority of previous research has ignored whether and how these analysts' interpreting forecasts affect the market reaction to the earnings announcements. The purpose of this study is to fill this gap by empirically investigating how market reactions to earnings announcements are affected by analysts' forecasts at the time of earnings announcements.

Prior research documents that analysts produce and disseminate new information to market. For example, firms with high analyst coverage tend to experience smaller hedge portfolio returns (Brennan, Jegadeesh, and Swaminathan 1993; Hong, Lim, and Stein 2000) and smaller magnitude of post-earnings announcement return drift (Bartov 1992; Zhang 2008). These studies use analysts as a proxy for informed traders, assuming that the amount of information generated by informed traders is positively correlated with the number of analyst following a firm. More rapid stock price adjustment to new information for firms with higher analyst coverage suggests that analysts play the role of new information provider in the market. However, public firm disclosures, such as earnings announcements, are also important sources of new information to the market and analysts' another important role is to interpret news from firm disclosures (Schipper 1991). Prior studies studies do not consider the analysts' interpreting role at such informational events. In this study, we focus on analysts' interpreting role by limiting our interest to informational event of earnings announcements and analysts' forecasting activities at the earnings announcements.

Several studies examine the effect of earnings announcements on disagreements among investors (e.g., Barron et al. 1998; Kandel and

Pearson 1995) and the association between disagreement among investors and trading volume (e.g., Bamber, Barron, and Stober 1997; Barron 1995; Barron, Harris, and Stanford 2005). These studies use individual analysts' forecast revisions made within relatively long periods around an earnings announcement (usually 45 days prior to and 30 days following the earnings announcement) as proxy for individual investor's belief revision. However, a significant portion of analysts issues forecasts almost at the same time with earnings announcements (Ivković and Jegadeesh 2004; Stickel 1989). Analytical studies suggest potential effect of analyst forecasts on market reaction to earnings announcement (Kim and Verrecchia 1994, 1997), but this issue has not been examined.

We first examine how analysts' forecasts affect trading volume reaction to earnings announcements. Analytical theories suggest that earnings announcements covey news regarding firm value and trigger temporary information asymmetry among investors (Admati and Pfleiderer 1988; Verrecchia 2001). Kim and Verrecchia (1994, 1997) suggest that some market participants who observe information from informed traders, like security analysts, use the information in conjunction with earnings announcements in a way to reduce errors contained in earnings news. This interpreting information stimulates investors' information judgments about earnings news, resulting in more trading based on earnings news. If the number of analyst forecasts at the time of earnings announcement reflects the amount of interpreting information regarding earnings news and the speed of information dissemination to market (Brennan, Jegadeesh, and Swaminathan 1993; Brennan and Subrahmanyam 1995), we expect a positive relation between trading volume reaction to earnings news and the number of analyst announcement period forecasts. We also examine how sensitivity of volume reactions is affected by the uncertainty in analysts' interpreting information.

We then examine whether the pricing impact of the earnings announcement varies with the number of analyst forecasts made during the announcement event window. Theory suggests that more trading make stock price more informative as stock price aggregates individuals' information (Admati and Pfleiderer 1988; Kim and Verrecchia 1994; Kyle 1985). If analysts help investors understand earnings signals regarding future earnings and make them trade based on earnings news, we expect that stock price reactions to

earnings news will be positively related with analysts' forecasting activities.

We conduct our empirical analysis on a sample of 115,761 firm-quarter observations with available data between 1996 and 2010. We measure the extent of analysts' interpreting activities by the number of analyst forecasts issued within two trading days after an earnings announcement (i.e., trading days 0 and 1 with respect to the announcement date). We study abnormal stock turnover ratios adjusted by firm-specific non-announcement period turnover ratios or three-digit SIC industry mean turnover ratios.

Our empirical results show that the trading volume reaction to stock price change increases monotonically with the number of analyst forecasts issued at the time of earnings announcement We regress abnormal trading volume on absolute stock return, the number of analyst forecasts, and the interaction between number of analyst forecasts and absolute stock return. We find that the magnitude of coefficients on stock price change is increasing with the number of analyst forecasts. Note that these results are obtained after controlling for other factors such as firm size, market-to-book ratio, analyst coverage, prior stock return volatility, and other firm disclosure characteristics. Especially, we control for analyst coverage as analyst forecasting activities are positively correlated with analyst coverage.

We also find less sensitive volume reactions to stock price changes for firms with large dispersion. We measure uncertainty of analysts' interpretations as forecast dispersion at the time of earnings announcement. Consistent with prior studies (Bamber, Barron, and Stober 1997, 1999; Barron 1995), we find higher level of trading volume for firm with higher dispersion in multivariate test. However, the sensitivity of trading volume to stock price change is smaller for firms with large dispersion. These results suggest uncertainty in analysts' interpretation weaken the informational effect of earnings announcement. Similar results are obtained when we use consensus measure developed Barron et al.'s (1998) as proxy for uncertainty in analyst forecasts.

Finally, we examine the implications of concurrent analyst forecasts for stock price reactions by regressing cumulative abnormal returns on unexpected earnings, the number of analyst forecasts, and the interaction between number of analyst forecasts and unexpected earnings. The evidence indicates that stock price

sensitivity is increasing in the number of announcement period forecasts. These results suggest that more active tradings related to earnings announcements make stock price reflect earnings news more quickly (Admati and Pfleiderer 1988; Kyle 1985). These results are consistent with findings by Jiang, Lee, and Zhang (2005) and Zhang (2006) that stocks prices adjust to earnings news more slowly when there is larger forecast dispersion.

Since greater stock price and trading volume reactions to earnings news could arise from unidentified disclosure characteristics rather than analysts' activities, we do additional tests to isolate the effect of analyst forecasts from the effect of the earnings announcement on market reactions. We first conduct a two-stage regression approach to isolate normal level of analysts' activities. In the first stage, we estimate the expected number of analysts' response to earnings announcement, using identified determinants of analysts' forecasts after earnings announcement (Stickel 1989; Zhang 2008). In the second stage, we examine the effect of unexpected analysts' response on market reactions. Empirical results show that unexpected number of analyst forecasts is positively associated with sensitivity of trading volume and stock price reactions to earnings announcement. Second, select sample firms that have analyst forecasts only on day 0 (or day 1) and have no forecasts on day 1 (or day 0). We then examine the market reaction over the sub-periods (-1, 0) and (1, 2) separately. We find that the positive relationship between sensitivity of stock price and volume reaction to earnings announcement and the number of analyst forecasts exists only in windows that analyst issue forecasts. These results suggest that it is analyst forecasts that affect stock price and trading volume at the time of earnings announcements and that our results are likely not attributable to other omitted variables.

Our study contributes to the extant literature in several ways. First, we contribute to the literature on the role of analysts in forming stock price. Theoretical studies suggest that market reaction to earnings announcements can be changed by the entrance of market experts like analysts (Kim and Verrecchia 1991b, 1994, 1997). Different from prior studies that focus on the level change in trading volume and properties of analyst forecasts (Bamber, Barron, and Stober 1997, 1999; Barron, Byard, and Kim 2002; Barron, Harris, and Stanford 2005; Kandel and Pearson 1995), we focus on difference in sensitivity of market reactions to earnings

announcements varying with informational activities of analysts. Our results are consistent with theoretical prediction that additional information by sophisticated investors helps dissemination of earnings news to market (Kim and Verrecchia 1991b, 1994, 1997). To our knowledge, our study is first to examine the information content of earnings differs with number of analyst forecasts, suggesting differential market reactions to earnings announcements documented by prior research may be partly attributable to analyst announcement period forecasts.

Second, our evidence provides insight into the role of analysts as information interpreters in the market. Ivković and Jegadeesh (2004) define the post-announcement period as trading days (2, 32) with respect to a current quarterly earnings announcement and pre-announcement period as days (-30, -1) with respect to the next quarterly earnings announcement. They find greater stock price reaction to pre-announcement analyst forecast revisions than to post-announcement revisions, and conclude that investors value analysts as new information producers in the period prior to the earnings announcement. However, Ivković and Jegadeesh (2004) do not examine the event period (0, 1), even though more than 20% of forecasts are revised in this period. Because analyst forecasts at the time of earnings announcement are more likely analyst interpretations of earnings news, examining the effect of analyst forecasts at the time of earnings announcement is critical to assessing the role of analysts as information interpreters. Our empirical evidence suggests that analyst interpretations of the announcement have incremental pricing implications beyond earnings.

Third, our study provides additional evidence on how analysts help disseminate new information to the market. Prior empirical evidence shows that analyst coverage is positively associated with the speed of price adjustment to new information (e.g., Brennan, Jegadeesh, and Swaminathan 1993; Elgers, Lo, and Pfeiffer 2001; Hong, Lim, and Stein 2000; Zhang 2008). Out study extends a prior research by providing more direct link between analysts' forecasting activities and the sensitivity of stock price and trading volume reactions to new information from earnings announcements. Especially, our empirical results are obtained after controlling for analyst coverage, suggesting that forecasts at the time of earnings announcement help disseminate new information to market in

addition to factors associated with analyst coverage.

The rest of this paper is organized as follows. We discuss the theoretical background in section 2, describe the research design in Section 3, present and discuss the results of the empirical analysis in Section 4, and provide our conclusions in Section 5.

## 2. THEORETICAL BACKGROUND

### 2.1. Analysts as Informed Investors

Several empirical studies examine the relation between the number of analysts and the speed of stock price adjustment to new information, using the number of analysts as a proxy for the number of informed traders. Brennan et al. (1993) compose hedge portfolios based on the number of analysts following a firm and value-weighted or equal-weighted market indices. They find that returns on these arbitrage portfolios are negatively related to lagged returns on the market indices, indicating that stock prices of firms followed by more analysts react more quickly to new information. Brennan and Subrahmanyam (1995) document a negative relation between the number of analysts and estimated adverse selection cost, suggesting that competition by informed traders reduces information asymmetry and leads to deeper markets. Hong et al. (2000) devise a momentum trading strategy based on past six month stock returns, firm size and analyst coverage. They find greater abnormal stock momentum returns for firms with low analyst coverage than for firms with high analyst coverage. Elgers et al. (2001) find that abnormal hedge portfolio returns based on analyst early-in-the-year earnings forecasts are more pronounced for firms with lower analyst coverage. In general, prior empirical evidence suggests that the number of analysts following a firm is positively associated with the speed of stock price adjustment to information contained in stock price.

Prior studies implicitly assume that analysts' primary role is information providers in the market by focusing on analyst coverage. However, firm disclosures, such as earnings announcements, are important information sources to investors and one of analysts' important roles is to provide interpretation of news from firm disclosures for their clients (Schipper 1991). Previous studies,

however, do not address the role played by analysts at the event of firm disclosures.

Earnings announcements are an important external information event through which firms convey significant new information to the market. Evidence shows that analysts tend to revise their forecasts immediately after the earnings announcement (Ivković and Jegadeesh 2004; Stickel 1989). Although there are many studies about the effect of earnings announcements on stock prices (see Lev [1989] for a review), there is little research on the role analysts play in disseminating information contained in earnings announcements. Further, prior empirical studies are silent on the pricing impact of earnings announcements when analysts generate information concurrent with firm disclosures.

Several studies examine the association between changes in properties of analyst forecasts around earnings announcement and the trading volume (Bamber, Barron, and Stober 1997, 1999; Barron 1995). These studies focus on effect of earnings announcement on information asymmetry among investors. In order to capture disagreement among investors, these studies commonly use analysts' forecast revisions made within relatively long period (usually 45 days prior to and 30 days following an earnings announcement). Therefore, their main focus is the overall association between trading volume and disagreement in analysts' forecasts. The potential effect of analysts' forecasts at the time of earnings announcement on information content of earnings announcement has not been explored yet.

Related to our study, Zhang (2008) reports more sensitive stock price reaction to unexpected earnings for firms with analysts' prompt forecasts following an earnings announcement. However, Zhang considers analyst forecast timing as the only attribute of analyst forecast properties. In addition, Zhang does not differentiate which role of analysts' new private information production or their interpretation of earnings news cause greater market reaction to earnings news as his main research focus is post-earnings-announcement stock return drift. We attempt to provide further insight on the role of analysts' forecasts as information interpreter by examining differential market reaction to earnings announcement varying with analyst forecasts.

### 2.2. Effect of Analyst Forecasts on Market Reaction to an Earnings Announcement

Our overall objective is to understand how the activities of analysts affect the market reaction to earnings news. Analyst forecasts in conjunction with the earnings announcement are commonly regarded as analysts' interpretations of earnings news from firm disclosure (Barron, Byard, and Kim 2002; Kandel and Pearson 1995; Stickel 1989). Consistent with prior studies (Brennan, Jegadeesh, and Swaminathan 1993; Brennan and Subrahmanyam 1995; Hong, Lim, and Stein 2000), we assume that the amount of information produced is positively associated with the number of analysts. However, different from prior studies that examine analyst coverage, we focus on event of public disclosures and analysts' interpretation role for new information contained in the disclosures. We use analysts' forecasts issued at the time of earnings announcement because these forecasts are commonly regarded as analysts' interpretations of earnings news (Schipper 1991). The issue of our study is how these analyst forecasts affect transmission of earnings news from firm to market.

Models of trade suggest a potential relation between analyst forecasts and trading volume. Especially, models of information-based trading suggest that trading volume is more likely to increase when investors revise their belief differentially (Karpoff 1986). Earnings announcements convey noisy signals about firm performance, where the error arises from the application of accounting practices such as conservatism, accrual-based estimates, etc. As investors revise their beliefs based on earnings news, their belief revisions could be different because of differential prior beliefs (Kim and Verrecchia 1991a, 1991b) or differential processing of errors contained in earnings news (Kim and Verrecchia 1994, 1997). The key assumption of these models is that investors revise their beliefs based on news from firm disclosures. Thus, the more earnings announcements stimulate investors to revise their beliefs, the more trading volume is likely to increase.

Kim and Verrecchia (1994, 1997) suggest that information from informed traders who have superior information relative to other market participants affect the market reaction to earnings news at the time of earnings announcements. Institutionally,

analysts' interpretation can be thought of as the information an analyst gleans by studying the error in accounting reports. As analysts' interpretations are used only in conjunction with earnings announcements in a way to reduce errors contained in earnings news, analysts' forecasts stimulates investors' information judgments about earnings news. Thus, analysts' interpretation information will lead investors to trade based on earnings news and more trading volume reactions to earnings announcements.

Consistent with prior studies (Brennan, Jegadeesh, and Swaminathan 1993; Brennan and Subrahmanyam 1995), we assume that the number of analyst forecasts at the time of earnings announcement is positively associated with the amount of information from analysts. We limit analysts' forecasts to ones issued at the event of earnings announcements. These forecasts are commonly regarded as analysts' interpretations of new information contained in earnings announcements (Schipper 1991). We expect a positive relation between trading volume reaction to earnings news and the number of analyst announcement period forecasts.

We also examine the sensitivity of stock price reaction to earnings announcement and analyst forecasting activities. Kim and Verrecchia's (1994) model indicates that earnings announcements stimulate information processing activities among investors. Because individual investors' information gathered in conjunction with the announcement is aggregated in stock price, stock prices are more informative when informed investors generate more private information. Similarly, Admati and Pfleiderer (1988) also predict a positive relation between the amount of information from informed investors and the speed with which share price reflects new information. Thus, the degree to which the number of analyst forecasts at the time of the earnings announcement reflects the amount of information related to earnings signals, we expect that stock price responses to unexpected earnings news is positively related with the number of analyst forecasts.

## 3. RESEARCH DESIGN

### 3.1 Sample Selection

We obtain data on sell-side analyst earnings forecasts for the

period January 1996 to December 2010 from the Institutional Brokers' Estimate System (I/B/E/S) detail tape. We use analyst forecast data after 1996 as we need to control for issuance of managerial guidance which is available after 1996. We focus on one-quarter-ahead (*q+1*) EPS forecasts revised since the current quarter (*q*) earnings announcement. We obtain earnings announcement dates from the COMPUSTAT quarterly files and stock return data from the Center for Research in Security Prices (CRSP) database.

### 3.2. Trading Volume Response to Stock Price Change

We estimate the following pooled cross-sectional regression model for a sample of quarterly earnings announcements to test the relation between analyst forecasting activities and investor trading activity:

$$\begin{aligned} CAbVol_{j,q} &= \alpha_0 + \alpha_1 SAnnFct_{j,q+1} + \alpha_2 LAnnFct_{j,q+1} + \alpha_3 AbsRet_{j,q} + \alpha_4 SAnnFct_{j,q+1} \times AbsRet_{j,q} \\ &+ \alpha_5 LAnnFct_{j,q+1} \times AbsRet_{j,q} + \alpha_6 MV_{j,q} + \alpha_9 PB_{j,q} + \alpha_7 Coverage_{j,q+1} + \alpha_8 VolRet_{j,q} \\ &+ \alpha_9 DGD_{j,q} + \alpha_{10} DCF_{j,q} + \alpha_{11} MV_{j,q} \times AbsRet_{j,q} + \alpha_{12} PB_{j,q} \times AbsRet_{j,q} \\ &+ \alpha_{13} Coverage_{j,q+1} \times AbsRet_{j,q} + \alpha_{14} VolRet_{j,q} \times AbsRet_{j,q} + \alpha_{15} VolRet_{j,q} \times AbsRet_{j,q} \\ &+ \alpha_{16} DGD_{j,q} \times AbsRet_{j,q} + \alpha_{17} DCFS_{j,q} \times AbsRet_{j,q} + \alpha_{18} QtrD4_{j,q} \times AbsRet_{j,q} \\ &+ \alpha_{19} NYSE_{j,q} + \alpha_{20} NASDAQ_{j,q} + \sum YearDummies + \sum QuarterDummies + e_{j,q} \end{aligned} \quad (1)$$

where for the firm *j*'s quarter *q* earnings announcement on day *τ*,

$CAbVol_{j,q}$ = cumulative abnormal trading volume either firm specific time-adjusted ($CAbVol^{T}_{j,q}$) or industry-adjusted ($CAbVol^{I}_{j,q}$) over the four-day window (-1, 2) around the earnings announcement date;

$AbsRet_{j,q}$= Cumulative absolute value of stock returns over days (-1, 2);

$SAnnFct_{j,q}$ = a dummy variable representing few analyst forecasts. It equals 1 if the number of announcement EPS forecasts for firm *j*'s quarter *q+1* EPS is less than or equal to three, and zero otherwise;

$LAnnFct_{j,q}$ = a dummy variable representing many analyst forecasts. It equals 1 if the number of announcement EPS forecasts for firm *j*'s quarter *q+1* EPS is greater than or equal to four, and zero otherwise;

$Coverage_{j,q}$ = log of one plus the number of analysts following firm *j* who issue quarter *q+1* EPS forecasts between the

quarter $q$ and $q+1$ earnings announcements;

$MV_{j,q}$ = firm size measured as the log of total market value of equity at the end of quarter $q$;

$PB_{j,q}$ = equity market-to-book ratio at the end of quarter $q$;

$VolRet_{j,q}$ = volatility of stock returns measured as the standard deviation of daily stock returns between 130 days and 10 days prior to the quarter $q$ earnings announcement date;

$DGD_{j,q}$ = a dummy variables representing an issuance of earnings guidance at the time of earnings announcement, and zero otherwise;

$DCFS_{j,q}$ = a dummy variables representing a disclosure of cash flow information at the time of earnings announcement, and zero otherwise;

$QtrD4_{j,q}$ = a dummy variables representing a $4^{th}$ quarter, measured as one if the fiscal quarter is 4, and zero otherwise;

$NYSE_{j,q}$ = a dummy variable representing the NYSE. It equals 1 if the firm is traded on the NYSE, and zero otherwise; and

$NASDAQ_{j,q}$ = a dummy variable representing the NASDAQ. It equals 1 if the firm is traded on the NASDAQ, and zero otherwise.

We use abnormal stock turnover ratio to measure trading volume around the earnings announcement. Lo et al. (2000) suggest that turnover, defined as shares traded divided by shares outstanding, is a better measure of trading activity. We measure four-day cumulative abnormal turnover by summing abnormal daily turnover during the event period. Following prior studies (Bamber 1986; Morse 1981), we use abnormal stock turnover (*CAbVol*), computed as daily turnover less expected turnover. We use two measures of expected turnover. The first measure is average turnover for the firm during the non-announcement period, defined as days (-40, -10) relative to the quarter $q$ earnings announcement ($CAbTVol^T$). The second measure of expected turnover is the average turnover for firms in the same three-digit SIC code industry on the same trading day ($CAbTVol^I$).

We use the four-days event window (days (-1, 2)) to capture the market reaction to the earnings announcement and the analyst forecasts made on days 0 and 1. In additional tests, we also use the three-days window (-1, 1), which is commonly used by previous

empirical research, to assess the sensitivity of our empirical results to this research design choice. The results are similar.

The primary test variable is the number of analyst announcement forecasts (*AnnFct*), which we define as the number of new or revised forecasts for the next quarterly EPS issued within two trading days following the current earnings announcement (i.e., days 0 and 1). To test whether the volume reaction systematically differs with the number of announcement forecasts, we include two dummy variables, *SAnnFct* and *LAnnFct*, for the number of announcement forecasts, and interact these dummy variables with absolute value of price changes (*AbsRet)*. We also estimate the relation between the number of announcement forecasts and stock return using a continuous measure of the number of announcement period forecasts.

Theoretical studies suggest that trading volume at the time of earnings announcement is affected by the magnitude of stock price change and the differential beliefs about earnings signals for future firm performance among investors (Kim and Verrecchia 1994). We measure the magnitude of stock price change by summing the absolute value of daily stock returns during the four-days event window (*AbsRet)*. We test whether volume response to stock price change during the earnings announcement varies with analyst forecasting activities.

The coefficient on *AbsRet* represents the volume response to stock price change for observations with no announcement period analyst forecasts. The coefficients of interest are $\alpha_4$ and $\alpha_5$, which reflect the difference between volume responses for observations with no announcement period analyst forecasts and observations with few and many announcement period forecasts, respectively. We expect $\alpha_4$ to be positive and $\alpha_5$ to be greater than $\alpha_4$.

We control for other factors that have been identified as determinants of trading volume. Prior studies shows that firm size (Amihud 2002; Atiase 1985), market-to-book ratio (Chordia, Subrahmanyam, and Anshuman 2001; Datar, Y. Naik, and Radcliffe 1998), and prior return volatility (Amihud and Mendelson 1986; Brennan and Subrahmanyam 1995) affect trading volume. Trading volume is also affected by the pre-announcement information environment (Verrecchia 2001). We include market value of equity (*MV*) and stock return volatility (*VolRet*) as proxies for information environment (e.g., Jiang, Lee, and Zhang 2005; Zhang

2006).[1] Volatility of stock returns is also related to transaction costs (Barnea and Logue 1975; Hamilton 1978; Stoll 1978). We also include dummy variables of disclosing cash flow information at the time of earnings announcement (*DCFS)* and issuance of earnings guidance (*DGD*) as firms disclosing these information may have differential disclosure practice and differential pricing impact of firm disclosures (Baber, Chen, and Kang 2006; Beyer 2009; Rogers and Van Buskirk 2013). Because prior studies find greater market response to fourth quarter earnings news than to other quarters' earnings news (e.g., Landsman and Maydew 2002), we also interact the fourth quarter dummy variable with price change. In order to control for potential fixed effect of stock market, we include dummy variables of stock markets (*NYSE* and *NASDAQ*).

Note that we include the analyst coverage (*Coverage*) in all regression models because the number of analysts' announcement forecasts is positively correlated with analyst coverage. By including *Coverage,* we control not only for potential effect of analyst coverage but also for differences in firm information environment varying with analyst coverage (Bhushan 1989; Lang and Lundholm 1996). In addition, by controlling for analyst coverage, the effect of analyst forecasts at the time of earnings announcement on trading volume is incremental (or additional) to the factors associated with analyst coverage. We add value of one to the number of analyst coverage to compute the log value of coverage.

### 3.3. Stock price response to forecast revisions

We estimate the following pooled cross-sectional regression model to test whether analyst forecasting activities affect stock price sensitivity to earnings announcements:

$$\begin{aligned} CAR_{j,q} = {} & \beta_0 + \beta_1 SAnnFct_{j,q+1} + \beta_2 LAnnFct_{j,q+1} + \beta_3 UE_{j,q} + \beta_4 SAnnFct_{j,q+1} \times UE_{j,q} \\ & + \beta_5 LAnnFct_{j,q+1} \times UE_{j,q} + \beta_6 AbsUE_{j,q} + \beta_7 Loss_{j,q} + \beta_8 Special_{j,q} + \beta_9 Coverage_{j,q+1} \\ & + \beta_{10} MV_{j,q} + \beta_{11} PB_{j,q} + \beta_{12} VolRet_{j,q} + \beta_{13} DGD_{j,q} + \beta_{14} DCF_{j,q} + \beta_{15} AbsUE_{j,q} \times UE_{j,q} \end{aligned} \quad (2)$$

1) We do not include analyst forecast dispersion because our sample includes firms without analyst coverage. We repeat the test on a sample that only includes firms with analyst coverage to control for analyst forecast dispersion. Our main results do not change after including analyst forecast dispersion. We also use the standard deviation of earnings volatility to measure prior information uncertainty, but the results does not change.

$$+\beta_{16}Loss_{j,q}\times UE_{j,q}+\beta_{17}Special_{j,q}\times UE_{j,q}+\beta_{18}Coverage_{j,q+1}\times UE_{j,q}+\beta_{19}MV_{j,q}\times UE_{j,q}$$
$$+\beta_{20}PB_{j,q}\times UE_{j,q}+\beta_{21}VolRet_{j,q}\times UE_{j,q}+\beta_{22}DGD_{j,q}\times UE_{j,q}+\beta_{23}DCF_{j,q}\times UE_{j,q}$$
$$+\beta_{24}QtrD4_{j,q}\times UE_{j,q}+\sum YearDummies+\sum QuarterDummies+e_{j,q}$$

where, for the firm *j*'s quarter *q* earnings announcement on day *τ*,

$CAR_{j,q}$ = value-weighted market-adjusted cumulative abnormal stock return (in percentage) over the four-days window (-1, 2) around the earnings announcement date;

$UE_{j,q}$ = unexpected earnings measured as actual earnings per share (EPS) minus the latest individual analyst forecast before the earnings announcement, divided by stock price at the end of the quarter;

$AbsUE_{j,q}$ = absolute value of unexpected earnings (*UE*);

$Loss_{j,q}$ = a dummy variable representing a negative earnings, measured as one if the EPS is negative, and zero otherwise; and

$Special_{j,q}$ = absolute value of restructuring charges deflated by total sales at the end of quarter *q*.

Since the stock reaction to an earnings announcement depends on the magnitude of new information contained in the announcement, we need proxy for unexpected earnings. We measure unexpected earnings (*UE*) by the difference between actual EPS and the latest individual analyst forecast before the quarter *q* earnings announcement. This is consistent Zhang (2008), so that we can compare our results with those of Zhang. We deflate the forecast error by the quarter end stock price. Because the demand for analyst interpretation services is endogenously determined, many of the determinants of analyst forecasting activities may also be determinants of the ERC (Stickel 1989; Zhang 2008). For this reason, we control for ERC determinants and allow *UE* to vary with these ERC determinants. We include market-to-book ratio (*PB*) to control for growth opportunities, and return volatility (*VolRet*) to control for firm risk and uncertainty of future cash flows (Zhang 2006). We use *Loss* and *Special* to control for earnings persistence because prior research indicates that earnings of loss firms and restructuring firms are less persistent (Hayn 1995). We include absolute value of forecast error (*AbsUE*) to control for nonlinearity in ERC (Freeman and Tse 1992) and log of firm market value (*MV*) to

control for differences in firm size (Easton and Zmijewski 1989). We also include dummy variables for fourth quarter (*DQtr4*), disclosure of cash flow information (*DCFS*), and managerial earnings guidance (*DGD*). We also include dummy variables to control for fiscal quarter and year fixed effects.

## 4. EMPIRICAL RESULTS

### 4.1. Univariate Results

Table 1 presents descriptive statistics for the sample firms used in this study. There are 115,761 firm-quarter observations that satisfy all the data requirements between 1996 and 2010. The average (median) number of announcement forecasts issued within two trading days following an announcement (*AnnFct*) is 3.55 (2.0). The average (median) number of analysts following a firm each quarter (*Coverage*) is 6.93 (5.0). On average, about 50% of analysts issue their forecasts during the announcement event window.[2)] The mean value of cumulative abnormal stock return (*CAR*) is 0.0036 and that of cumulative absolute stock return (*AbsRet*) is 0.1155. As expected, the means of both firm- and industry-adjusted abnormal trading volume around earnings announcements are significantly positive (0.0224 and 0.0312, respectively). Average unexpected earnings (*UE*) is 0.0004 and average absolute unexpected earnings (*AbsUE*) is 0.0036. The average market value of firms is $5,923 million and about 20 percent of firms experience negative earnings (*Loss*). Average value of restructuring charges (*Special*) is 0.49% of sales. About 16% of firms disclose earnings guidance (DGD) at the same time with earnings announcements and 93.6% of firms disclose cash flow information (*DCFS*).

Panel B presents descriptive statistics for sample firms with zero (*AnnFct* = 0), few (1<=*AnnFct*<=3) and many number of announcement forecasts (*AnnFct*>=4). We have 31,579 observations

2) The frequency of analyst forecasts immediately after earnings announcement is higher than that of Ivković and Jegadeesh (2004) because they use only forecast revisions, whereas we use all forecasts issued. Our samle period also include longer periods of post Regulation Fair Disclosure effective in 2000 when analysts are more likely to rely on earings announcement to revise their forecasts (Hahn and Song 2012).

**Table 1. Sample Descriptive Statistics between January 1990 and 2010**
**Panel A. Descriptive statistics for the full sample**

| Variable | N | Mean | Std Dev | 25th Pctl | Median | 75th Pctl |
|---|---|---|---|---|---|---|
| *AnnFct* | 115,761 | 3.5542 | 4.3615 | 0.0000 | 2.0000 | 5.0000 |
| *CAR* | 115,761 | 0.0036 | 0.0818 | -0.0377 | 0.0022 | 0.0448 |
| $CabVol^{T}$ | 115,761 | 0.0224 | 0.0339 | 0.0017 | 0.0106 | 0.0309 |
| $CabTVol^{I}$ | 115,234 | 0.0312 | 0.0446 | 0.0022 | 0.0155 | 0.0449 |
| *UE* | 115,761 | 0.0004 | 0.0083 | -0.0003 | 0.0004 | 0.0018 |
| *AbsUE* | 115,761 | 0.0036 | 0.0075 | 0.0004 | 0.0012 | 0.0033 |
| *AbsRet* | 115,761 | 0.1155 | 0.0811 | 0.0576 | 0.0946 | 0.1509 |
| *MV* | 115,761 | 5,923 | 20,811 | 312 | 962 | 3,289 |
| *PB* | 115,761 | 3.1159 | 3.0678 | 1.4361 | 2.1943 | 3.5742 |
| *Coverage* | 115,761 | 6.9277 | 5.9396 | 3.0000 | 5.0000 | 10.0000 |
| *VolRet* | 115,761 | 0.0303 | 0.0167 | 0.0184 | 0.0262 | 0.0378 |
| *Loss* | 115,761 | 0.2064 | 0.4047 | 0.0000 | 0.0000 | 0.0000 |
| *Special* | 115,761 | 0.0049 | 0.0284 | 0.0000 | 0.0000 | 0.0000 |
| *QtrD4* | 115,761 | 0.2291 | 0.4203 | 0.0000 | 0.0000 | 0.0000 |
| *DGD* | 115,761 | 0.2049 | 0.4036 | 0.0000 | 0.0000 | 0.0000 |
| *DCFS* | 115,761 | 0.9359 | 0.2450 | 1.0000 | 1.0000 | 1.0000 |

without announcement period forecasts and 43,106 observations with few analyst forecasts and 41,148 observations with many announcement forecasts. One of our sample selection criteria is that at least one analyst follow a firm in order to compute unexpected earnings. This requirement explains why we have more observations with announcement forecasts than without announcement forecasts.

The mean (median) value of *CAR* is increasing with the number of analyst forecasts. Both the mean and median value of abnormal stock turnover (C*AbVol*) and stock price change (*AbsRet*) for announcement forecast firms are increasing with the number of announcement forecasts. However, untabulated t-test results show that there is no significant difference in average value of *CAR, AbsRet* between groups of few and many analyst forecasts. Not surprisingly, announcement forecast sample firms have larger size (*MV*), market-to-book ratio (*PB*), and analyst coverage (*Coverage*), and lower value of unexpected earnings (*AbsUE*), absolute amount of restructuring charges (*Special*) and the frequency of negative earnings (*Loss*).

**Table 1. (continued)**
**Panel B. Descriptive statistics conditional on analysts' issuance of announcement forecast**

| | *Non-announcement Forecast (AnnFct=0)* (n=31,579) | | | *Small Number of Announcement Forecast (1<=AnnFct <=3)* (n=43,016) | | | *Large Number of Announcement Forecast (4<=AnnFct)* (n=41,148) | | |
|---|---|---|---|---|---|---|---|---|---|
| *Variable* | Mean | Median | Std Dev | Mean | Median | Std Dev | Mean | Median | Std Dev |
| *AnnFct* | - | - | - | 1.79 | 2.00 | 0.80 | 8.12 | 7.00 | 4.36 |
| *CAR* | 0.0027 | 0.0007 | 0.0777 | 0.0039 | 0.0027 | 0.0838 | 0.0040 | 0.0031 | 0.0829 |
| $CAbVol^{T}$ | 0.0138 | 0.0048 | 0.0279 | 0.0190 | 0.0085 | 0.0311 | 0.0325 | 0.0201 | 0.0382 |
| $CAbTVol^{I}$ | 0.0185 | 0.0063 | 0.0355 | 0.0257 | 0.0119 | 0.0405 | 0.0467 | 0.0309 | 0.0502 |
| *UE* | -0.0000 | 0.0003 | 0.0100 | 0.0004 | 0.0004 | 0.0085 | 0.0008 | 0.0005 | 0.0063 |
| *AbsUE* | 0.0044 | 0.0014 | 0.0089 | 0.0037 | 0.0012 | 0.0077 | 0.0028 | 0.0010 | 0.0057 |
| *AbsRet* | 0.1101 | 0.0885 | 0.0820 | 0.1178 | 0.0966 | 0.0826 | 0.1173 | 0.0972 | 0.0787 |
| *MV* | 2,133 | 361 | 10,371 | 3,276 | 716 | 12,932 | 11,600 | 2,744 | 30,174 |
| *PB* | 2.8120 | 1.9641 | 2.8404 | 2.9864 | 2.0997 | 2.9540 | 3.4848 | 2.4970 | 3.3068 |
| *Coverage* | 2.5205 | 2.0000 | 2.7696 | 5.0630 | 4.0000 | 3.2948 | 12.2612 | 11.0000 | 5.9174 |
| *VolRet* | 0.0321 | 0.0283 | 0.0175 | 0.0309 | 0.0269 | 0.0168 | 0.0283 | 0.0244 | 0.0157 |
| *Loss* | 0.2298 | 0.0000 | 0.4207 | 0.2133 | 0.0000 | 0.4097 | 0.1811 | 0.0000 | 0.3851 |
| *Special* | 0.0054 | 0.0000 | 0.0311 | 0.0052 | 0.0000 | 0.0297 | 0.0041 | 0.0000 | 0.0247 |
| *QtrD4* | 0.2408 | 0.0000 | 0.4276 | 0.2158 | 0.0000 | 0.4114 | 0.2340 | 0.0000 | 0.4234 |
| *DGD* | 0.1311 | 0.0000 | 0.3375 | 0.1751 | 0.0000 | 0.3801 | 0.2926 | 0.0000 | 0.4550 |
| *DCF* | 0.8816 | 1.0000 | 0.3231 | 0.9394 | 1.0000 | 0.2386 | 0.9739 | 1.0000 | 0.1596 |

Note:
*AnnFct* = number of analysts' announcement forecast that are issued during event days (0, 1) with respect to quarter *q* earrings announcement. We use log value of *AnnFct* plus one in multivariate regression model;
*CAR* = value-weighted market-adjusted cumulative abnormal stock return (in percentage) over the four-day window (-1, 2) around the earnings announcement date;
$CAbVol^{T}$ = firm-specific non-announcement period adjusted cumulative abnormal turnover ratio around quarter *q* earnings announcement date;
$CAbVol^{I}$ = industry-adjusted cumulative abnormal turnover ratio around quarter *q* earnings announcement date;
*UE* = unexpected earnings measured as actual earnings per share (EPS) minus the latest individual analyst forecast before the earnings announcement, divided by stock price at the end of the quarter;
*AbsRet* = cumulative absolute stock returns around earnings announcement measured by summing each absolute stock return during event days [-1, 2] with respect to quarter *q* earnings announcement;
*PB* = equity market-to-book ratio at the end of quarter *q*;
*AbsUE* = absolute value of *UE*;
*MV* = firm size measured by the log of total market value of firm at the end of quarter *q;*
*Coverage* = number of analysts following firm *j* who issue quarter *q+1* EPS forecasts between the quarter *q* and *q+1* earnings announcements. We use log value of coverage plus one in multivariate regression model;
*VolRet* = volatility of stock returns measured by the standard deviation of daily stock returns during event days (-40, -10) with respect to quarter *q* earnings announcement date;
*Loss* = a dummy variable representing a negative earnings, measured as one if the EPS is negative, and zero otherwise;
*Special* = restructuring charges deflated by total assets at the end of quarter *q*;
*DGD* = a dummy variables representing an issuance of earnings guidance at the time of earnings announcement, and zero otherwise;
*DCFS* = a dummy variables representing a disclosure of cash flow information at the time of earnings announcement, and zero otherwise;
*NYSE* = a dummy variable representing the NYSE. It equals 1 if the firm is traded on the NYSE, and zero otherwise; and
*NASDAQ* = a dummy variable representing the NASDAQ. It equals 1 if the firm is traded on the NASDAQ, and zero otherwise; and
*QtrD4* = dummy variables for $4^{th}$ quarter, measured as one if the fiscal quarter is 4 and zero otherwise.

### 4.2. Regression Results

Table 2 presents estimation results for three variations of equation (1). Model 1 regresses *CAbVol* on *AbsRet* and its interaction with the two dummy variables for the number of announcement period forecasts, *SAnnFct* and *LAnnFct*, for the full sample of observations that includes observations with and without announcement period forecasts. This formulation allows us to compare the volume-return relation for observations with no announcement forecasts, observations with few announcement forecasts, and observations with many announcement forecasts. Model 2 treats the number of announcement forecasts as a continuous variable rather than as a binary variable. In model 3, it ignores observations with no announcement forecasts and focuses on observations with few and many announcement forecasts.

The model 1 results indicate that the coefficient on *AbsRet* is significantly positive at the one percent level (0.0805, t = 9.86). This is consistent with the predictions of analytical studies that trading volume is positively related with price changes (Verrecchia 2001). The coefficient on *SAnnFct* is significantly negative (-0.0013, t = -3.08), but that on *LAnnFct* is significantly positive (0.0025, t = 4.32). This result indicates that the overall trading volume is positively associated with the number of analysts' announcement forecasts, suggesting that more analyst forecasting activities could increase the quantity of information available over the event period. The coefficients on the interaction terms *SAnnFct*AbsRet* and *LAnnFct*AbsRet* are 0.0122 (t = 0.419) and 0.0420 (t = 10.65), respectively, and both coefficients are statistically and economically significant at one percent level. In addition, the difference in magnitudes of these two coefficients is significantly positive (0.0298, $p < 0.01$), indicating that the relation between trading volume reaction and price change is increasing with the number of announcement period forecasts. These results demonstrate that the impact of stock price change on trading volume is greater when analysts issue more forecasts at the time of the earnings announcement and indicate that information asymmetry among investors at the time of the earnings announcement increases with the number of announcement period forecasts.

Model 2 estimates equation (1) using continuous value of log value

**Table 2. Multivariate Regression of abnormal trading volume around quarterly earnings announcement on the change in stock price and the number of announcement forecasts**

$$CAbVol_{j,q} = \alpha_0 + \alpha_1 SAnnFct_{j,q+1} + \alpha_2 LAnnFct_{j,q+1} + \alpha_3 AbsRet_{j,q} + \alpha_4 SAnnFct_{j,q+1} \times AbsRet_{j,q} + \alpha_5 LAnnFct_{j,q+1} \times AbsRet_{j,q} + \alpha_6 MV_{j,q} + \alpha_9 PB_{j,q} + \alpha_7 Coverage_{j,q+1} + \alpha_8 VolRet_{j,q} + \alpha_9 DGD_{j,q} + \alpha_{10} DCF_{j,q} + \alpha_{11} MV_{j,q} \times AbsRet_{j,q} + \alpha_{12} PB_{j,q} \times AbsRet_{j,q} + \alpha_{13} Coverage_{j,q+1} \times AbsRet_{j,q} + \alpha_{14} VolRet_{j,q} \times AbsRet_{j,q} + \alpha_{15} VolRet_{j,q} \times AbsRet_{j,q} + \alpha_{16} DGD_{j,q} \times AbsRet_{j,q} + \alpha_{17} DCFS_{j,q} \times AbsRet_{j,q} + \alpha_{18} QtrD4_{j,q} \times AbsRet_{j,q} + \alpha_{17} NYSE_{j,q} + \alpha_{16} NASDAQ_{j,q} + \sum YearDummies + \sum QuarterDummies + e_{j,q}$$

| Variables | Pooled Sample | | Pooled sample | | Sample firms with announcement forecasts | |
|---|---|---|---|---|---|---|
| | Estimate | t Value | Estimate | t Value | Estimate | t Value |
| *Intercept* | 0.0065 | 5.52 *** | 0.0064 | 5.43 *** | | |
| *SAnnFct* | -0.0013 | -3.08 *** | | | -0.0018 | -1.09 |
| *LAnnFct* | 0.0025 | 4.32 *** | | | 0.0000 | -0.01 |
| *AbsRet* | 0.0805 | 9.86 *** | 0.0863 | 10.6 *** | | |
| *SannFct*AbsRet* | 0.0122 | 4.19 *** | | | 0.1290 | 11.39 *** |
| *LannFct*AbsRet* | 0.0420 | 10.65 *** | | | 0.1543 | 12.42 *** |
| *lnAnnFct* | | | 0.0026 | 9.3 *** | | |
| *lnAnnFct*AbsRet* | | | 0.0299 | 15.23 *** | | |
| *MV* | -0.0009 | -7.21 *** | -0.0009 | -7.39 *** | -0.0014 | -9.01 *** |
| *PB* | 0.0001 | 2.50 ** | 0.0001 | 2.2 ** | 0.0002 | 3.24 *** |
| *Coverage* | 0.0013 | 4.18 *** | 0.0001 | 0.23 | 0.0045 | 9.76 *** |
| *VolRet* | -0.1073 | -9.23 *** | -0.1109 | -9.56 *** | -0.0662 | -4.51 *** |
| *DGD* | 0.0022 | 5.62 *** | 0.0021 | 5.52 *** | 0.0024 | 5.43 *** |
| *DSCF* | -0.0026 | -4.27 *** | -0.0026 | -4.29 *** | -0.0019 | -2.23 ** |
| *MV*AbsRet* | 0.0108 | 12.47 *** | 0.0104 | 12.01 *** | 0.0074 | 6.58 *** |
| *PB*AbsRet* | 0.0026 | 8.24 *** | 0.0027 | 8.62 *** | 0.0033 | 8.73 *** |
| *Coverage*AbsRet* | 0.0192 | 8.78 *** | 0.0105 | 4.53 *** | 0.0280 | 8.64 *** |
| *VolRet*AbsRet* | -1.7860 | -31.86 *** | -1.7663 | -31.58 *** | -2.0807 | -30.21 *** |
| *DGD*AbsRet* | -0.0060 | -2.25 ** | -0.0074 | -2.78 *** | -0.0068 | -2.19 ** |
| *DSCF*AbsRet* | 0.0397 | 6.26 *** | 0.0364 | 5.74 *** | 0.0172 | 1.93 * |
| *QtrD4*AbsRet* | 0.0354 | 13.87 *** | 0.0346 | 13.58 *** | 0.0376 | 12.11 *** |
| *NYSE* | 0.0034 | 5.61 *** | 0.0032 | 5.4 *** | 0.0042 | 4.68 *** |
| *NASDAQ* | 0.0072 | 12.24 *** | 0.0068 | 11.63 *** | 0.0083 | 9.41 *** |
| *N* | | 115,761 | | 115,761 | | 84,164 |
| $R^2$ | | 0.2578 | | 0.2607 | | 0.4424 |
| F-Test LAnnFct*AbsRet - SAnnFct*AbsRet | 0.0298 | 101.26 *** | | | 0.0253 | 81.43 *** |

***, **, * significant at 1%, 5%, and 10% level, respectively.
*SAnnFct* is dummy variables of value one if the number of analyst forecasts at the time of earnings announcement (*AnnFct*) is greater than zero and less or equal to three, zero otherwise; *LAnnFct* is dummy variables of value one if *AnnFct* is greater than four, zero otherwise. *lnAnnFct* is the log of one plus the number of analysts' announcement forecast. All models include year and quarter dummies. Please see table 1 for definition of variables.

of one plus the number of announcement forecasts (*lnAnnFct*).[3] The coefficient on the interaction between *lnAnnFct *AbsRet* is significantly positive (0.0299, t = 15.23), suggesting that trading volume reaction to stock returns is increasing with analysts' activities. Model 3 limit sample firms to ones that have at least one announcement forecast. The coefficients on *SAnnFct*AbsRet* and *LAnnFct*AbsRet* are each significantly positive and the coefficient on *LannFct*AbsRet* is greater than the coefficient on *SannFct*AbsRet* (0.0253, $p < 0.01$). These results are consistent with the results for model 1.

Regarding the control variables, volume response sensitivity to stock return is increasing with firm size (*MV*), market-to-book ratio (*PB*) and analyst coverage (*Coverage*), and cash flow information disclosure (*DCFS*) and decreasing with return volatility (*VolRet*) and issuance of firm earnings guidance (*DGD*).

### 4.3. Uncertainty of analyst forecasts and volume reaction

If analysts' forecasts play the role of interpretation of earnings news, analysts' interpretation information is used only in conjunction with earnings news and conveys information regarding noise in earnings signals (Kim and Verrecchia 1997). Uncertainty in analysts' interpretation may affect pricing effect of earnings announcement. For example, less uncertainty in analysts' interpretation regarding earnings news can give investors better understanding of signals of current earnings regarding firm future performance. This will more stimulate investors' processing of earnings news to revise their estimate of firm value, resulting in larger trading volume reaction to earnings announcements.

We measure the uncertainty in analyst forecasts' interpretation by forecast dispersion. Analyst forecast dispersion is commonly used as proxy for either uncertainty in analyst forecasts positively correlated with uncertainty in earnings (Imhoff and Lobo 1992; Jiang, Lee, and Zhang 2005; Zhang 2006). Alternatively, analyst forecast dispersion may also reflect diversity in beliefs among investors (Bamber, Barron, and Stober 1997; Barron 1995). More diverse interpretations among investors is positively associated with trading volume (Kim

3) We add one to the number of analyst forecasts to take log value of the number of analyst forecasts.

and Verrecchia 1994, 1997). Thus, the degree to which analyst forecast dispersion reflect the uncertainty or diversity in analyst forecasts, the effect of dispersion on trading volume will change.

We measure analyst forecast dispersion by the standard deviation of analyst forecasts issued at the time of earnings announcement, deflated by quarter end stock price. In order to measure dispersion, we require a minimum of three forecasts at the time of earnings announcements. Then, we assign the firms with dispersion greater (less) than sample median value of dispersion to high (low) dispersion sub-sample in each year.

Panel A in table 3 presents the descriptive statistics on variables based on analyst forecast dispersion. In general, those firms with low dispersion tend to have large number of announcement forecasts (6.67 versus 7.54). Although mean and median values are significantly different, the differences are not economically significant. Not surprisingly, firms with lower dispersion tend to be larger (*MV*), have smaller average value of earnings surprise (*UE* and *AbsUE*) and stock price change (*AbsRet*), return volatility (*VolRet*).

Firms with high dispersion have lower firm-specific adjusted trading volume ($CAbVol^T$, 0.0301) than firms with lower dispersion (0.0311). On the other hand, the industry-adjusted trading volume ($CAbVol^I$) is larger for firms with high dispersion (0.0444 versus 0.0429). Lager value of $CAbVol^T$ for low dispersion firms looks like inconsistent with prior evidence that firms with higher dispersion tend to have higher trading volume (Bamber, Barron, and Stober 1997, 1999; Barron 1995). Note that this is univariate result without controlling for other factors. We find the level of change in trading volume is increasing with dispersion in multivariate regression as we discussed later.[4)]

Panel B documents results of regression of trading volume on the number of analyst forecasts (*lnAnnFct)* and stock price change

4) We also find that this difference is because of sample selection. Prior studies require sample firms to have a minimum number of revisions made by the same analysts around an earnings announcement, resulting in sample firms followed by a larger number of analysts who are active in forecast revisions. When we limit our sample firms to ones with large number of forecasts, we also find that the level of trading volume is increasing with dispersion. For example, when we require a minimum of seven forecasts, the mean (median) value of abnormal trading volume for high dispersion firms is 0.0373 (0.0247), while that of low dispersion firms is 0.0362 (0.0237). However, our empirical results of sensitivity of volume reaction to stock price changes do not change for this sample.

(*AbsRet*). As our sample firms are limited to firms with a minimum of three forecasts, we use continuous variables of *lnAnnFct* rather than dummy variables. We find positive coefficients on stock price changes (*AbsRet*) and the number of announcement forecasts (*lnAnnFct*AbsRet)*. In general, results of regression of trading volume and the number of analyst forecasts for both small and large dispersion groups are similar to our previous test results.

Regarding difference in two samples, we find the magnitudes of coefficients on *Intercept* and the number of analyst forecasts (*lnAnnFct*) is larger for large dispersion firms. For example, coefficient on *lnAnnFct* for high dispersion firms is 0.0075 and that for low dispersion firms is 0.0024. The difference in the magnitude of coefficients is significant at one percent level (0.0050, t = 2.88). In addition, the magnitude of intercepts for high dispersion firms is larger than that of low dispersion (0.0097, t = 1.67). These results are consistent with prior evidence that the overall level change in abnormal trading volume is positively associated with forecast dispersion (Bamber, Barron, and Stober 1997, 1999; Barron 1995).

The sensitivity of volume reaction to stock price change (*AbsRet*), however, is higher for firms with low dispersion (0.1322 versus 0.2567). Note that prior studies examining the effect of forecast dispersion on trading volume do not examine the sensitivity of volume reactions. The magnitude of coefficient on *lnAnnFct*AbsRet* is significantly larger for low dispersion firms (0.0724) than high dispersion firms (0.0524). The difference in magnitude of coefficients is significantly different at ten percent level (difference = -0.0200, t = -1.66). The degree to which forecast dispersion reflects uncertainty in analysts' interpretations of earnings news, the result suggests that investors' trading based on earnings news is decreasing with uncertainty in analysts' interpretations.

The effect of analyst forecast dispersion on trading volume shows both properties of proxies for diversity in investor beliefs and for uncertainty in earnings signals. These results could be because analyst forecast dispersion has both properties of diverse beliefs among individuals or uncertainty in common information (Barron et al. 1998).

In general, empirical results suggest that analysts' announcement forecasts increase the market reaction to the new information contained in earnings announcement. Especially, analysts' less uncertain forecasts help investors incorporate new information.

**Table 3. Comparison of trading volume reaction to stock price changes between high and analyst forecast dispersion**

$$CAbVol_{j,q} = \alpha_0 + \alpha_1 SAnnFct_{j,q+1} + \alpha_2 LAnnFct_{j,q+1} + \alpha_3 AbsRet_{j,q} + \alpha_4 SAnnFct_{j,q+1} \times AbsRet_{j,q} + \alpha_5 LAnnFct_{j,q+1} \times AbsRet_{j,q} + \alpha_6 MV_{j,q}$$
$$+ \alpha_9 PB_{j,q} + \alpha_7 Coverage_{j,q+1} + \alpha_8 VolRet_{j,q} + \alpha_9 DGD_{j,q} + \alpha_{10} DCF_{j,q} + \alpha_{11} MV_{j,q} \times AbsRet_{j,q} + \alpha_{12} PB_{j,q} \times AbsRet_{j,q}$$
$$+ \alpha_{13} Coverage_{j,q+1} \times AbsRet_{j,q} + \alpha_{14} VolRet_{j,q} \times AbsRet_{j,q} + \alpha_{15} VolRet_{j,q} \times AbsRet_{j,q} + \alpha_{16} DGD_{j,q} \times AbsRet_{j,q} + \alpha_{17} DCFS_{j,q} \times AbsRet_{j,q}$$
$$+ \alpha_{18} QtrD4_{j,q} \times AbsRet_{j,q} + \alpha_{17} NYSE_{j,q} + \alpha_{16} NASDAQ_{j,q} + \sum YearDummies + \sum QuarterDummies + e_{j,q}$$

**Panel A. Descriptive statistics conditional on analyst forecast dispersion at the time of earnings announcement**

| Variable | High Dispersion (N=25,451) | | *Low Dispersion* (N=25,759) | | Difference | |
|---|---|---|---|---|---|---|
| | Mean | Median | Mean | Median | Mean | Median |
| *AnnFct* | 6.67 | 5.00 | 7.54 | 6.00 | 0.87 *** | 1.00 *** |
| *CAR* | 0.0017 | 0.0014 | 0.0065 | 0.0049 | 0.0048 *** | 0.0035 *** |
| $CAbVol^T$ | 0.0301 | 0.0177 | 0.0311 | 0.0189 | 0.0011 *** | 0.0012 *** |
| $CAbTVol^I$ | 0.0444 | 0.0288 | 0.0429 | 0.0271 | -0.0015 *** | -0.0017 *** |
| *UE* | 0.0008 | 0.0007 | 0.0007 | 0.0004 | -0.0001 ** | -0.0003 *** |
| *AbsUE* | 0.0044 | 0.0020 | 0.0012 | 0.0006 | -0.0032 *** | -0.0014 *** |
| *AbsRet* | 0.1267 | 0.1056 | 0.1086 | 0.0905 | -0.0181 *** | -0.0151 *** |
| *MV* | 6,666 | 1,522 | 13,647 | 3,310 | 6,981 *** | 1,787 *** |
| *PB* | 2.6953 | 1.9329 | 4.1500 | 3.0439 | 1.4547 *** | 1.1111 *** |
| *Coverage* | 10.73 | 9.00 | 11.56 | 10.00 | 0.8279 *** | 1.0000 *** |
| *VolRet* | 0.0316 | 0.0273 | 0.0255 | 0.0223 | -0.0061 *** | -0.0051 *** |
| *Loss* | 0.2885 | 0.0000 | 0.0807 | 0.0000 | -0.2078 *** | 0.0000 *** |
| *Special* | 0.0052 | 0.0000 | 0.0032 | 0.0000 | -0.0020 *** | 0.0000 *** |
| *QtrD4* | 0.2364 | 0.0000 | 0.2265 | 0.0000 | -0.0099 *** | 0.0000 *** |
| *DGD* | 0.2104 | 0.0000 | 0.3414 | 0.0000 | 0.1311 *** | 0.0000 *** |
| *DCFS* | 0.9795 | 1.0000 | 0.9625 | 1.0000 | -0.0169 *** | 0.0000 *** |

These results are more consistent with analysts' interpretation role that analysts' interpreting forecasts help investors better understand the earnings signals. Our results also provide complimentary evidence that firms with small analyst forecast dispersion tend to experience less post-earnings stock return drift (Jiang, Lee, and Zhang 2005; Zhang 2006). Our results show that more trading for firms with small dispersion imply that market are more likely to impound new information from earnings announcements quickly.

Our empirical results also imply that the increased trading volume associated with analyst forecasts may increase market liquidity. Previous studies frequently measure market liquidity as the ratio of the sum of the daily volume to the sum of the absolute return (Amihud, Mendelson, and Lauterbach 1997; Chordia,

**Table 3. (continued)**
**Panel B. Comparison of trading volume response to stock price change based on analyst forecast dispersion at the time of earnings announcements**

| Variables | High Dispersion | | Low Dispersion | | Difference (High – Low) | |
|---|---|---|---|---|---|---|
| | Estimate | t Value | Estimate | t Value | Estimate | t Value |
| *Intercept* | -0.0028 | -0.69 | -0.0126 | -3.10 *** | 0.0097 | 1.67 * |
| *AbsRet* | 0.1322 | 5.15 *** | 0.2567 | 10.40 *** | -0.1245 | -3.49 *** |
| *lnAnnFct* | 0.0075 | 5.71 *** | 0.0024 | 2.12 ** | 0.0050 | 2.88 *** |
| *lnAnnFct*AbsRet* | 0.0524 | 6.08 *** | 0.0724 | 8.63 *** | -0.0200 | -1.66 * |
| *MV* | -0.0025 | -7.20 *** | -0.0019 | -6.21 *** | -0.0006 | -1.32 |
| *PB* | 0.0001 | 0.63 | 0.0004 | 3.90 *** | -0.0003 | -1.73 * |
| *Coverage* | 0.0023 | 1.64 | 0.0045 | 3.54 *** | -0.0023 | -1.21 |
| *VolRet* | -0.1336 | -4.69 *** | 0.1178 | 3.75 *** | -0.2513 | -5.88 *** |
| *DGD* | 0.0027 | 2.86 *** | 0.0015 | 2.10 ** | 0.0011 | 0.96 |
| *DSCF* | -0.0010 | -0.39 | -0.0003 | -0.18 | -0.0006 | -0.21 |
| *MV*AbsRet* | 0.0158 | 7.06 *** | -0.0117 | -4.99 *** | 0.0275 | 8.43 *** |
| *PB*AbsRet* | 0.0023 | 2.61 *** | 0.0037 | 5.96 *** | -0.0015 | -1.39 |
| *Coverage*AbsRet* | -0.0151 | -1.64 | 0.0107 | 1.14 | -0.0258 | -1.95 * |
| *VolRet*AbsRet* | -1.8836 | -14.72 *** | -2.9276 | -19.61 *** | 1.0440 | 5.25 *** |
| *DGD*AbsRet* | -0.0143 | -2.42 ** | -0.0019 | -0.34 | -0.0124 | -1.53 |
| *DSCF*AbsRet* | -0.0282 | -1.36 | -0.0134 | -0.72 | -0.0148 | -0.53 |
| *QtrD4*AbsRet* | 0.0298 | 5.16 *** | 0.0273 | 4.41 *** | 0.0025 | 0.29 |
| *NYSE* | 0.0055 | 2.62 *** | 0.0091 | 3.23 *** | -0.0036 | -1.01 |
| *NASDAQ* | 0.0086 | 4.09 *** | 0.0139 | 4.95 *** | -0.0054 | -1.50 |
| *N* | | 25,451 | | 25,759 | | 51,210 |
| $R^2$ | | 0.2534 | | 0.3154 | | 0.2742 |

***, **, * significant at 1%, 5%, and 10% level, respectively.
Forecast dispersion is measured by standard deviation of analyst forecasts issued at the time of earnings announcements, deflated by quarter end stock price. Firms with dispersion value greater (less) than median value of dispersion in each year are assigned to high (low) dispersion firms. *lnAnnFct* is log of one plus the number of analysts' announcement forecast. All models include year and quarter dummy variables. Please see table 1 for definition of other variables.

Subrahmanyam, and Anshuman 2001; Cooper, Groth, and Avera 1985; Datar, Y. Naik, and Radcliffe 1998; Haugen and Baker 1996; Khan and Baker 1993). The coefficient on absolute stock price change could be interpreted as the Admati and Pfleiderer (1988) measure of market liquidity. Our results are consistent with the prediction by Admati and Pfleiderer (1988) that the entrance of

informed traders in the market increases the informativeness of stock prices, leading to higher market liquidity.

### 4.4. Stock Return Response to Earnings Announcements

In this section, we investigate how analysts' forecasting activities affect the sensitivity of stock price response to earnings news. Trading reveals traders' information that is ultimately incorporated into stock price (Kim and Verrecchia 1991a, 1991b). Thus, more trading will lead stock price to reflect information available in the market, which results in more quick incorporation of new information. As we find greater trading volume reaction to earnings announcement when more number of analysts issue forecasts, we examine how greater trading volume results in more sensitive price reaction to earnings announcement.

The model 1 results indicate that the coefficient on *UE* is significantly positive at the one percent level (3.2288). The coefficients on the interaction terms *SAnnFct*UE* and *LAnnFct*UE* are 0.4696 (t = 6.46) and 1.0296 (t = 9.12), respectively, and both coefficients are statistically and economically significant. Zhang (2008) finds that the ERC is higher when analysts issue forecasts at the time of earnings announcement. We further show that the sensitivity of stock price reaction to earnings news is increasing with the number of analysts' activities. The magnitude of the coefficient relating *CAR* and *UE* is increasing in the number of announcement forecasts. The difference between the coefficients on *LAnnFct*UE* and *SAnnFct*UE* is 0.5588 ($p < 0.01$), and is statistically significantly greater from zero.

Regarding the control variables, analyst coverage (*Coverage*), issuance of earnings guidance (*DGD*) and cash flow information (*DCFS*), and market-to-book ratio (*PB*) have significantly positive effects on the returns-earnings relation, while restructuring charge (*Special*), negative earnings (*Loss*), and stock return volatility (*VolRet)* have a significantly negative effect. In general, these results are consistent with expectations. We repeat the test using continuous variables of the number of analyst forecasts (model 2) and sample firms with analyst forecasts (model 3). The major results do not change with regression model.

We also examine how uncertainty in analyst forecasts affects the stock price reaction to earnings news and analyst forecasts. Similar

**Table 4. Regression results of stock price reaction to unexpected earnings and analyst forecasts**

**Panel A. Stock price response to unexpected earnings and the number of analyst forecasts that are issued within two trading days following an earnings announcement**

$$CAR_{j,q} = \beta_0 + \beta_1 SAnnFct_{j,q+1} + \beta_2 LAnnFct_{j,q+1} + \beta_3 UE_{j,q} + \beta_4 SAnnFct_{j,q+1} \times UE_{j,q} + \beta_{10} MV_{j,q} + \beta_5 LAnnFct_{j,q+1} \times UE_{j,q} + \beta_6 AbsUE_{j,q}$$
$$+ \beta_7 Loss_{j,q} + \beta_8 Special_{j,q} + \beta_9 Coverage_{j,q+1} + \beta_{11} PB_{j,q} + \beta_{12} VolRet_{j,q} + \beta_{13} DGD_{j,q} + \beta_{14} DCF_{j,q} + \beta_{15} AbsUE_{j,q} \times UE_{j,q}$$
$$+ \beta_{16} Loss_{j,q} \times UE_{j,q} + \beta_{17} Special_{j,q} \times UE_{j,q} + \beta_{18} Coverage_{j,q+1} \times UE_{j,q} + \beta_{19} MV_{j,q} \times UE_{j,q} + \beta_{20} PB_{j,q} \times UE_{j,q} + \beta_{21} VolRet_{j,q} \times UE_{j,q}$$
$$+ \beta_{22} DGD_{j,q} \times UE_{j,q} + \beta_{23} DCF_{j,q} \times UE_{j,q} + \beta_{24} QtrD4_{j,q} \times UE_{j,q} + \sum YearDummies + \sum QuarterDummies + e_{j,q}$$

| Variables | Pooled sample | | Sample firms that have announcement forecasts | | Pooled Sample | |
|---|---|---|---|---|---|---|
| | Estimate | t-statistic | Estimate | t-statistic | Estimate | t-statistic |
| *Intercept* | 0.0030 | 1.59 | 0.0031 | 1.63 | | |
| *SAnnFct* | 0.0003 | 0.40 | | | -0.0013 | -0.54 |
| *LAnnFct* | -0.0009 | -0.97 | | | -0.0025 | -0.93 |
| *UE* | 3.2288 | 13.36 *** | 3.3182 | 13.75 *** | | |
| *SAnnFct*UE* | 0.4696 | 6.46 *** | | | 3.8509 | 10.5 *** |
| *LAnnFct*UE* | 1.0296 | 9.12 *** | | | 4.3545 | 10.92 *** |
| *lnAnnFct* | | | -0.0009 | -1.83 * | | |
| *lnAnnFct*UE* | | | 0.5477 | 9.62 *** | | |
| *AbsUE* | -0.0427 | -1.12 | -0.0441 | -1.16 | -0.0290 | -0.58 |
| *Loss* | -0.0126 | -19.11 *** | -0.0126 | -19.12 *** | -0.0128 | -16.01 *** |
| *Special* | -0.0315 | -3.80 *** | -0.0313 | -3.77 *** | -0.0344 | -3.37 *** |
| *Coverage* | 0.0003 | 0.69 | 0.0007 | 1.25 | 0.0003 | 0.45 |
| *MV* | -0.0007 | -3.56 *** | -0.0007 | -3.58 *** | -0.0005 | -2.00 ** |
| *PB* | 0.0000 | -0.13 | 0.0000 | -0.11 | 0.0002 | 1.76 * |
| *VolRet* | -0.0757 | -3.99 *** | -0.0749 | -3.95 *** | -0.0228 | -0.98 |
| *DGD* | 0.0014 | 2.38 ** | 0.0014 | 2.38 ** | 0.0009 | 1.26 |
| *DCFS* | 0.0038 | 3.75 *** | 0.0039 | 3.84 *** | 0.0034 | 2.42 ** |
| *AbsUE*UE* | -46.7840 | -35.28 *** | -46.7129 | -35.22 *** | -56.3124 | -32.36 *** |
| *Loss*UE* | -1.0452 | -14.84 *** | -1.0528 | -14.95 *** | -1.2819 | -13.96 *** |
| *Special*UE* | -1.5137 | -2.60 *** | -1.5266 | -2.63 *** | -1.6267 | -2.16 ** |
| *Coverage*UE* | 0.2379 | 4.06 *** | 0.1689 | 2.71 *** | 0.2287 | 2.5 ** |
| *MV*UE* | -0.1314 | -5.80 *** | -0.1352 | -5.96 *** | -0.1118 | -3.57 *** |
| *PB*UE* | 0.0213 | 1.93 * | 0.0207 | 1.88 * | 0.0326 | 2.07 ** |
| *VolRet*UE* | -5.5140 | -4.07 *** | -5.5297 | -4.08 *** | -5.6760 | -3.29 *** |
| *DGD*UE* | 0.1806 | 2.02 ** | 0.1735 | 1.95 * | 0.3870 | 3.36 *** |
| *DCFS*UE* | 1.2598 | 6.29 *** | 1.2547 | 6.27 *** | 1.5924 | 5.27 *** |
| *QtrD4*UE* | -0.5410 | -8.37 *** | -0.5440 | -8.42 *** | -0.8097 | -9.6 *** |
| *N* | | 115,761 | | 115,761 | | 84,164 |
| $R^2$ | | 0.0555 | | 0.0556 | | 0.0659 |
| *F-test* *LAnnFct*UE - SAnnFct*UE* | 0.5588 | 38.25 *** | | | 0.5025 | 22.81 *** |

**Table 4. (continued)**

**Panel B. Comparison of stock price response to unexpected earnings based on analyst forecast dispersion at the time of earnings announcements**

| Variables | High Dispersion | | Low Dispersion | | Difference (High – Low) | |
|---|---|---|---|---|---|---|
| | Estimate | t-statistic | Estimate | t-statistic | Estimate | t-statistic |
| *Intercept* | -0.0022 | -0.38 | -0.0028 | -0.62 | 0.0007 | 0.09 |
| *UE* | 4.4676 | 6.32 *** | 6.0707 | 2.18 ** | -1.6030 | -0.52 |
| *lnAnnFct* | -0.0077 | -3.79 *** | -0.0020 | -1.11 | -0.0057 | -2.11 ** |
| *lnAnnFct*UE* | 0.6839 | 2.84 *** | 2.6993 | 3.49 *** | -2.0154 | -2.32 ** |
| *AbsUE* | -0.0742 | -0.85 | -1.5760 | -5.93 *** | 1.5018 | 5.02 *** |
| *Loss* | -0.0118 | -8.69 *** | -0.0075 | -4.12 *** | -0.0043 | -1.84 * |
| *Special* | -0.0297 | -1.56 | -0.0509 | -2.31 ** | 0.0212 | 0.71 |
| *Coverage* | 0.0034 | 1.63 | 0.0003 | 0.15 | 0.0031 | 1.1 |
| *MV* | 0.0003 | 0.50 | -0.0006 | -1.46 | 0.0009 | 1.33 |
| *PB* | 0.0002 | 1.12 | -0.0001 | -0.66 | 0.0003 | 1.31 |
| *VolRet* | -0.0085 | -0.20 | 0.0767 | 1.59 | -0.0852 | -1.29 |
| *DGD* | 0.0013 | 0.93 | -0.0013 | -1.18 | 0.0025 | 1.47 |
| *DCFS* | 0.0036 | 0.94 | 0.0023 | 0.87 | 0.0014 | 0.3 |
| *AbsUE*UE* | -58.9670 | -19.60 *** | -255.8887 | -23.68 *** | 196.9217 | 16.35 *** |
| *Loss*UE* | -1.3624 | -8.73 *** | -3.8374 | -7.75 *** | 2.4750 | 4.45 *** |
| *Special*UE* | -0.8653 | -0.57 | -3.7657 | -1.02 | 2.9003 | 0.68 |
| *Coverage*UE* | 0.0673 | 0.26 | 0.3486 | 0.42 | -0.2813 | -0.3 |
| *MV*UE* | -0.2430 | -4.03 *** | -0.1947 | -0.90 | -0.0483 | -0.2 |
| *PB*UE* | 0.0161 | 0.67 | 0.7412 | 8.49 *** | -0.7251 | -7.45 *** |
| *VolRet*UE* | -9.3975 | -3.16 *** | 26.3600 | 2.02 ** | -35.7574 | -2.48 ** |
| *DGD*UE* | 0.2348 | 1.22 | 0.4457 | 1.00 | -0.2109 | -0.41 |
| *DCFS*UE* | 1.5242 | 2.62 *** | 0.5973 | 0.25 | 0.9269 | 0.35 |
| *QtrD4*UE* | -1.0324 | -7.45 *** | -1.9491 | -4.73 *** | 0.9168 | 1.97 ** |
| *N* | 25,451 | | 25,759 | | | |
| $R^2$ | 0.0822 | | 0.0802 | | | |

***, **, * significant at 1%, 5%, and 10% level, respectively.

*SAnnFct* is dummy variables of value one if the number of analyst forecasts at the time of earnings announcement (*AnnFct*) is greater than zero and less or equal to three, zero otherwise; *LAnnFct* is dummy variables of value one if *AnnFct* is greater than four, zero otherwise. Forecast dispersion is measured by standard deviation of analyst forecasts issued at the time of earnings announcements, deflated by quarter end stock price. Firms with dispersion value greater (less) than median value of dispersion in each year are assigned to high (low) dispersion firms. *lnAnnFct* is log of one plus the number of analysts' announcement forecast. All models include year and quarter dummy variables. Please see table 1 for definition of other variables.

to previous test, we divide sample firms into two groups based on analyst forecast dispersion. Panel B reports the empirical results. We find stronger stock price reaction to earnings news (*UE*) for firms with low dispersion, but the difference is not statistically significant (-1.6030, t = -0.52). However, when more analysts issue forecasts with low dispersion (*lnAnnFct*UE*), we find significantly larger magnitude of stock reactions to earnings announcement (difference = -2.0154, t = -2.32). Our finding is consistent with finding by Imhoff and Lobo (1992) that uncertainty in analyst forecasts is negatively associated with the magnitude of ERCs.

The results of higher stock price reaction to unexpected earnings are consistent with our results that analysts' forecasts trigger more trading, which helps stock price incorporate new information more quickly. These results suggest that analysts' forecasts help the dissemination of new information into market and analysts' forecasts play the role of interpretation.

### 4.5. Robustness Test

One concern of our results is that the number of analyst forecasts might be affected by firm disclosure quality which is positively correlated with analyst coverage (Bhushan 1989; Lang and Lundholm 1996). Because effects of earnings announcement and analyst forecasts are compounded for the firms with announcement forecasts, observed more sensitive stock price and trading volume response to unexpected earnings are attributable to analyst forecasts or other factors correlated with analyst announcement forecasts. Although our regression model includes analyst coverage to control for this potential effect, we further attempt to separate the effect of analyst forecasts from the effect of the earnings shock.

First, we use two-stage regression that mitigates the concerns of correlation between analyst coverage and the number of announcement forecasts. Specifically, we first estimate the expected number of announcement period forecasts, following earlier empirical work on the determinants of analyst forecast issuance at the time of earnings announcement (Stickel 1989; Zhang 2008). By using unexpected number of analyst forecasts at the time of earnings announcement, we exclude potential analysts' forecasting behaviors that are correlated firm characteristics and analyst coverage.

In the first stage, we estimate the logarithm of one plus the number of announcement period forecasts as a linear function of absolute value of unexpected earnings (*AbsUE*), cumulative abnormal trading volume in prior quarter (*CAbVol*), firm size (*MV*), market-to-book ratio (*PB*), analyst coverage (*Coverage*), negative earnings (*Loss*), volatility of prior returns (*VolRet*), research and development expenditure (*RD),* extraordinary expenses (*Special),* average broker size measured by the average number of analyst employed by a brokerage firm (*BrokerSize*), average analyst experience measured by the average number of years since analysts cover the firm (*Experience)*, and negative earnings (*NegEN*). We also include quarter dummy variables. We estimate unexpected number of announcement forecast (*Resi_AnnFct)* using the residuals from the first regression in each year. In the second stage, we examine the relation between unexpected announcement period forecasts and unexpected earnings, using equation (1) and (2).

$$\begin{aligned} AnnFct_{j,q+1} = {} & \lambda_0' + \lambda_1' CAbVol_{j,q-1} + \lambda_2' AbsUE_{j,q} + \lambda_3' MV_{j,q} + \lambda_4' PB_{j,q} + \lambda_5' Coverage'_{j,q+1} + \lambda_6' Loss_{j,q} \\ & + \lambda_7' VolRet_{j,q} + \lambda_8' NegEN_{j,q} + \lambda_9' Special_{j,q} + \lambda_{10}' RD_{j,q} + \lambda_{11}' Experience_{j,q} \\ & + \lambda_{12}' BrokerSize_{j,q} + \sum \lambda QuarterDummies + \varepsilon_{j,q} \end{aligned} \quad (3)$$

Table 5 reports the estimation results. Panel A reports the average value of coefficients on determinants of the number of analyst forecasts at the time of earnings announcements. We find significantly positive coefficients on prior quarter abnormal trading volume ($CAbVol_{q-1}$), firm size (*MV*), market-to-book ratio (*PB*), return volatility (*VolRet*), and R&D expenditure (*RD*) and negative coefficient on special items in income statement (*Special*). We do not find significant coefficient on absolute value of unexpected earnings (*AbsUE*). In general, these results are consistent with prior empirical results from Stickel (1989) and Zhang (2008). The average value of R-square is about 0.64, which indicate that the explanatory power of the model is high.

Panel B reports the regression results of trading volume on analyst forecasts. The coefficient on *Resi_lnAnnFct* is significantly positive (0.0625, t = 7.51). In addition, the coefficient on interaction term of *Resi_lnAnnFct *AbsRet* is also significantly positive (0.0078, t=3.50). These results suggest that stock price changes accompanied with number of forecasts more than usual level is are more likely to increase trading volume.

**Table 5. Two-Stage Least Square Regression of abnormal trading volume around quarterly earnings announcements on unexpected number of announcement forecasts**

**Panel A. 1st stage regression results for the number of analyst forecasts at the time of earnings announcement**

$$AnnFct_{j,q+1} = \lambda_0^{'} + \lambda_1^{'}CAbVol_{j,q-1} + \lambda_2^{'}AbsUE_{j,q} + \lambda_3^{'}MV_{j,q} + \lambda_4^{'}PB_{j,q} + \lambda_5^{'}Coverage_{j,q+1}^{'} + \lambda_6^{'}Loss_{j,q} + \lambda_7^{'}VolRet_{j,q} + \lambda_8^{'}NegEN_{j,q} + \lambda_9^{'}Special_{j,q} + \lambda_{10}^{'}RD_{j,q} + \lambda_{11}^{'}Career_{j,q} + \lambda_{12}^{'}Experience_{j,q} + \sum \lambda QuarterDummies + \varepsilon_{j,q}$$

| Variable | Mean | t-value |
|---|---|---|
| *Intercept* | -0.7167 | -12.43 *** |
| $C4AbVol_{q-1}$ | 1.0657 | 10.93 *** |
| *AbsUE* | -0.4210 | -0.84 |
| *MV* | 0.0319 | 3.62 *** |
| *PB* | 0.0066 | 4.23 *** |
| *Coverage* | 0.7711 | 14.91 *** |
| *VolRet* | 2.3677 | 3.51 *** |
| *NegEN* | -0.0012 | -0.13 |
| *Special* | -0.0879 | -3.48 *** |
| *RD* | 0.0958 | 4.98 *** |
| *Avg_Career* | 0.0121 | 1.29 |
| *Avg_Broker* | 0.0152 | 2.00 * |
| *QtrD2* | 0.0146 | 1.48 |
| *QtrD3* | 0.0082 | 0.43 |
| *QtrD4* | 0.0298 | 1.98 * |
| *N* | 15 | |
| $R^2$ | 0.6416 | |

In panel B, we report the regression of stock returns on unexpected earnings. Because the interaction between *UE* and *Resi_AnnFct* will be positive when both variables are negative or positive, we separate unexpected earnings into two groups based on whether it is positive (*PUE*) or negative (*NUE*) for return regression. We use the absolute value for *NUE* so that the interaction between *NUE* and *Resi_AnnFct* is increasing with their value. We expect a negative relation between *CAR* and *NUE* as larger *NUE* will result in more negative stock price change.

The coefficient on *PUE* is significantly positive (2.9341, $p < 0.01$) and the coefficient on *NUE* significantly negative (-3.0686, $p < 0.01$). The coefficient on *PUE*Resi_AnnFct* is significantly positive (0.6895, t = 6.56) and the coefficient on *NUE*Resi_AnnFct* negative (-0.5369, t = - 6.06), indicating that stock price is more sensitive to unexpected

**Table 5. (continued)**

**Panel B. 2nd stage regression results for cumulative abnormal trading volume on unexpected analysts' announcement forecasts**

$$CAbVol_{j,q} = \alpha_0 + \alpha_1' Resi\_AnnFct_{j,q+1} + \alpha_3 AbsRet_{j,q} + \alpha_4' Resi\_AnnFct_{j,q+1} \times AbsRet_{j,q} + \alpha_6 MV_{j,q} + \alpha_9 PB_{j,q} + \alpha_7 Coverage_{j,q+1}$$
$$+ \alpha_8 VolRet_{j,q} + \alpha_9 DGD_{j,q} + \alpha_{10} DCF_{j,q} + \alpha_{11} MV_{j,q} \times AbsRet_{j,q} + \alpha_{12} PB_{j,q} \times AbsRet_{j,q} + \alpha_{13} Coverage_{j,q+1} \times AbsRet_{j,q}$$
$$+ \alpha_{14} VolRet_{j,q} \times AbsRet_{j,q} + \alpha_{15} VolRet_{j,q} \times AbsRet_{j,q} + \alpha_{16} DGD_{j,q} \times AbsRet_{j,q} + \alpha_{17} DCFS_{j,q} \times AbsRet_{j,q}$$
$$+ \alpha_{18} QtrD4_{j,q} \times AbsRet_{j,q} + \alpha_{19} NYSE_{j,q} + \alpha_{20} NASDAQ_{j,q} + \sum YearDummies + \sum QuarterDummies + e_{j,q}$$

| | Estimate | t-value |
|---|---|---|
| *Intercept* | 0.0052 | 4.27 *** |
| *AbsRet* | 0.0030 | 9.11 *** |
| *Resi_lnAnnFct* | 0.0656 | 7.48 *** |
| *Resi_lnAnnFct*AbsRet* | 0.0092 | 3.89 *** |
| *MV* | -0.0008 | -5.94 *** |
| *PB* | 0.0001 | 2.38 ** |
| *Coverage* | 0.0020 | 8.00 *** |
| *VolRet* | -0.0865 | -6.84 *** |
| *DGD* | 0.0018 | 4.59 *** |
| *DSCF* | -0.0033 | -5.25 *** |
| *MV*AbsRet* | 0.0105 | 11.30 *** |
| *PB*AbsRet* | 0.0031 | 8.48 *** |
| *Coverage*AbsRet* | 0.0337 | 18.38 *** |
| *VolRet*AbsRet* | -1.8896 | -30.35 *** |
| *DGD*AbsRet* | -0.0033 | -1.17 |
| *DSCF*AbsRet* | 0.0510 | 7.32 *** |
| *QtrD4*AbsRet* | 0.0351 | 12.97 *** |
| *NYSE* | 0.0040 | 6.17 *** |
| *NASDAQ* | 0.0075 | 11.81 *** |
| *N* | 109,816 | |
| $R^2$ | 0.2587 | |

earnings news and unexpected analyst forecasts. In general, two-stage regression show that analyst forecasts more than normal level is more likely to affect sensitivity of trading volume and stock price reactions to earnings announcements.

We also attempt to separate the effect of analyst forecasts from earnings announcement by narrowing down event windows based on existence of analyst forecasts. More specifically, we first decompose the analyst announcement forecast subsample based on whether the analyst forecasts are made only on event day 0 or only event day 1. We exclude sample observations that have analyst forecasts on both days 0 and 1. This reduces the total number of observations

**Panel C. 2nd stage regression results for cumulative abnormal returns on unexpected analysts' announcement forecasts**

$$CAR_{j,q} = \beta_0 + \beta_1' Resi\_lnAnnFct_{j,q+1} + \beta_2' PUE_{j,q} + \beta_3' NUE_{j,q} + \beta_3' Resi\_AnnFct_{j,q+1} \times PUE_{j,q} + \beta_4' Resi\_AnnFct_{j,q+1} \times NUE_{j,q}$$
$$+ \beta_7 Loss_{j,q} + \beta_8 Special_{j,q} + \beta_9 Coverage_{j,q+1} + \beta_{10} MV_{j,q} + \beta_{11} PB_{j,q} + \beta_{12} VolRet_{j,q} + \beta_{13} DGD_{j,q} + \beta_{14} DCF_{j,q} + \beta_{15} AbsUE_{j,q} \times UE_{j,q}$$
$$+ \beta_{16} Loss_{j,q} \times UE_{j,q} + \beta_{17} Special_{j,q} \times UE_{j,q} + \beta_{18} Coverage_{j,q+1} \times UE_{j,q} + \beta_{19} MV_{j,q} \times UE_{j,q} + \beta_{20} PB_{j,q} \times UE_{j,q} + \beta_{21} VolRet_{j,q} \times UE_{j,q}$$
$$+ \beta_{22} DGD_{j,q} \times UE_{j,q} + \beta_{23} DCF_{j,q} \times UE_{j,q} + \beta_{24} QtrD4_{j,q} \times UE_{j,q} + \sum YearDummies + \sum QuarterDummies + e_{j,q}$$

| Variables | Expected Sign | Estimate | t-value |
|---|---|---|---|
| *Intercept* | | 0.0016 | 0.82 |
| *Resi_lnAnnFct* | | -0.0009 | -1.53 |
| *PUE* | | 3.0807 | 11.47 *** |
| *NUE* | | -3.2340 | -11.87 *** |
| *Resi_lnAnnFct*PUE* | + | 0.7233 | 6.34 *** |
| *Resi_lnAnnFct*NUE* | - | -0.5236 | -5.50 *** |
| *Loss* | | -0.0119 | -16.88 *** |
| *Special* | | -0.0358 | -4.02 *** |
| *Coverage* | | -0.0003 | -0.85 |
| *MV* | | -0.0005 | -2.40 ** |
| *PB* | | -0.0001 | -0.66 |
| *VolRet* | | -0.0494 | -2.36 ** |
| *DGD* | | 0.0012 | 1.91 * |
| *DCFS* | | 0.0041 | 3.79 *** |
| *AbsUE*UE* | | -50.5453 | -34.55 *** |
| *Loss*UE* | | -1.0493 | -13.59 *** |
| *Special*UE* | | -1.3002 | -2.12 ** |
| *Coverage*UE* | | 0.6524 | 13.21 *** |
| *MV*UE* | | -0.0954 | -3.70 *** |
| *PB*UE* | | 0.0444 | 3.21 *** |
| *VolRet*UE* | | -7.3124 | -4.60 *** |
| *DGD*UE* | | 0.1082 | 1.12 |
| *DCFS*UE* | | 1.1774 | 5.32 *** |
| *QtrD4*UE* | | -0.5780 | -8.13 *** |
| *N* | | 109,816 | |
| $R^2$ | | 0.057966 | |

***, **, * significant at 1%, 5%, and 10% level, respectively.

*Special* is extraordinary items in income statement deflated by sales; *RD* is research and development expenses in income statement deflated by sales; *Avg_Career* is analysts' average career measured as the log of average value of the number of quarters since the analysts first appear in I/B/E/S; and *Avg_Broker* is average value of brokerage firm size measured as the log of average value of the number of analysts employed by the brokerage firms. If a firm does not report extraordinary item or R&D expenses, we treat them as zero. All models include year and quarter dummy variables. Please see table 1 for definition of variables.

to 38,440 and 71,092 for firms with analyst forecasts on only day 0 or day 1, respectively. We then divide the event window into two sub-periods, (-1, 0) and (1, 2). For those firms with forecasts issued only on day 1, and no forecasts on day 0, the stock price reaction during event window (-1, 0) is more likely to be affected by the earnings shock, *UE* or *AbsRet*, and less likely to be affected by analyst forecasts. On the other hand, stock price reaction during the (1, 2) window will be affected by both unexpected earnings and the analyst forecasts. If announcement period forecasts alter the return-earnings relation, then the price reaction in the (1, 2) window will be related to the number of announcement forecasts and the price reaction in the (-1, 0) window will not.

Table 6 presents the empirical results. Panel A shows regression results for the subsample with no announcement forecasts on day 0 but forecasts only on day 1. The first column reports the return reaction to *AbsRet* during the (-1, 0) window. We find a significantly positive coefficient on *AbsRet*, indicating that stock volume reaction is is strongly related to stock price change. We also find both coefficients on *LAnnFct*AbsRet* (0.0012, t = 0.28) and *SAnnFct*AbsRet* (0.0036, t = 1.38) are insignificant.

The second column of panel A reports regression results for the (1, 2) window. In this window, trading volume is likely to be affected by two information sources: analyst forecasts and earnings announcements. The coefficient on *AbsRet* is still significantly positive, suggesting that stock returns during window (1, 2) are still affected by earnings news. The coefficient on *SAnnFct*UE* is 0.0194 (t = 6.53) and the coefficient on *LAnnFct*UE* is 0.0284 (t = 6.47). Both coefficients are statistically significant at the one percent level, and the coefficient on *LannFct*AbsRet* is significantly larger than the coefficient on *SAnnFct*AbsRet* (0.0132, $p<0.01$).

Similarly, we repeat the test using subsample with announcement forecasts on only day 0 and no announcement period forecasts on day 1. Panel B reports the results. In general, we find positive relationship between the sensitivity of trading volume reactions to earnings announcement and the number of analyst forecasts in the period with analyst forecasts, we do not find this relation when there is no forecasts.[5] We also repeat these tests with divided sub-

5) During window (1, 2) we find negative coefficient on *AbsRet* (-0.0146, t = -1.44), suggesting that trading volume does not react to earnings news in this Window.

**Table 6. Trading volume response to stock price change and analyst forecasts during the event window (-1, 0) and (1, 2) around an earnings announcement**

$$CAbVol_{j,q} = \alpha_0 + \alpha_1 SAnnFct_{j,q+1} + \alpha_2 LAnnFct_{j,q+1} + \alpha_3 AbsRet_{j,q} + \alpha_4 SAnnFct_{j,q+1} \times AbsRet_{j,q} + \alpha_5 LAnnFct_{j,q+1} \times AbsRet_{j,q} + \alpha_6 MV_{j,q}$$
$$+ \alpha_9 PB_{j,q} + \alpha_7 Coverage_{j,q+1} + \alpha_8 VolRet_{j,q} + \alpha_9 DGD_{j,q} + \alpha_{10} DCF_{j,q} + \alpha_{11} MV_{j,q} \times AbsRet_{j,q} + \alpha_{12} PB_{j,q} \times AbsRet_{j,q}$$
$$+ \alpha_{13} Coverage_{j,q+1} \times AbsRet_{j,q} + \alpha_{14} VolRet_{j,q} \times AbsRet_{j,q} + \alpha_{15} VolRet_{j,q} \times AbsRet_{j,q} + \alpha_{16} DGD_{j,q} \times AbsRet_{j,q} + \alpha_{17} DCFS_{j,q} \times AbsRet_{j,q}$$
$$+ \alpha_{18} QtrD4_{j,q} \times AbsRet_{j,q} + \alpha_{17} NYSE_{j,q} + \alpha_{16} NASDAQ_{j,q} + \sum YearDummies + \sum QuarterDummies + e_{j,q}$$

**Panel A. Firms with at least one announcement period forecast on event day 1and no announcement period forecast on event day 0.**

| Variables | Window (-1, 0) | | Window (1, 2) | |
|---|---|---|---|---|
| | Estimate | t Value | Estimate | t Value |
| *Intercept* | 0.0015 | 2.44 ** | 0.0038 | 4.87 *** |
| *SAnnFct* | 0.0002 | 0.99 | 0.0001 | 0.46 |
| *LannFct* | 0.0020 | 6.61 *** | 0.0043 | 10.81 *** |
| *AbsRet* | 0.0715 | 9.38 *** | 0.0167 | 1.82 * |
| *SannFct*AbsRet* | 0.0036 | 1.38 | 0.0194 | 6.53 *** |
| *LannFct*AbsRet* | 0.0012 | 0.28 | 0.0284 | 6.47 *** |
| *MV* | 0.0001 | 1.71 * | -0.0003 | -3.36 *** |
| *PB* | 0.0000 | -0.58 | 0.0000 | 1.20 |
| *Coverage* | -0.0009 | -6.13 *** | 0.0003 | 1.84 * |
| *VolRet* | -0.0934 | -16.44 *** | -0.0577 | -7.90 *** |
| *DGD* | -0.0004 | -1.67 * | 0.0005 | 2.00 ** |
| *DSCF* | 0.0000 | 0.08 | -0.0010 | -2.76 *** |
| *MV*AbsRet* | 0.0069 | 8.04 *** | 0.0151 | 15.26 *** |
| *PB*AbsRet* | 0.0014 | 4.36 *** | 0.0024 | 6.83 *** |
| *Coverage*AbsRet* | 0.0061 | 3.05 *** | 0.0210 | 9.25 *** |
| *VolRet*AbsRet* | -0.9840 | -17.93 *** | -1.3079 | -21.19 *** |
| *DGD*AbsRet* | -0.0061 | -2.19 ** | -0.0043 | -1.42 |
| *DSCF*AbsRet* | 0.0256 | 4.39 *** | 0.0545 | 7.61 *** |
| *QtrD4*AbsRet* | 0.0262 | 10.19 *** | 0.0280 | 9.93 *** |
| *NYSE* | 0.0008 | 2.41 ** | 0.0018 | 4.37 *** |
| *NASDAQ* | 0.0014 | 4.69 *** | 0.0040 | 10.13 *** |
| *N* | | 71,092 | | 71,092 |
| *Adjusted R-squre* | | 0.1403 | | 0.2831 |
| *F-Test LAnnFct*AbsRet - SAnnFct*AbsRet* | -0.0006 | 0.03 | 0.0132 | 15.31 *** |

One possible interpretation of this result is that analysts' forecasts make stock market incorporate new information fully in window (-1, 0) so that there is earnings news have little effect in window (1, 2).

**Table 6. (continued)**

**Panel B. Firms with at least one announcement period forecast on event day 0 and no announcement forecast on event day 1.**

| Variables | Window (-1, 0) | | Window (1, 2) | |
|---|---|---|---|---|
| | Estimate | t Value | Estimate | t Value |
| *Intercept* | 0.0049 | 6.33 *** | 0.0082 | 9.89 *** |
| *SAnnFct* | 0.0017 | 5.69 *** | 0.0013 | 4.17 *** |
| *LannFct* | 0.0037 | 4.14 *** | 0.0011 | 1.12 |
| *AbsRet* | 0.0587 | 6.43 *** | -0.0146 | -1.44 |
| *SannFct*AbsRet* | 0.0154 | 4.07 *** | -0.0356 | -7.60 *** |
| *LannFct*AbsRet* | 0.0638 | 5.44 *** | -0.0044 | -0.24 |
| *MV* | -0.0002 | -2.14 ** | -0.0004 | -4.60 *** |
| *PB* | -0.0001 | -1.89 * | -0.0001 | -1.46 |
| *Coverage* | -0.0006 | -3.29 *** | -0.0002 | -0.99 |
| *VolRet* | -0.0959 | -12.39 *** | -0.0995 | -11.84 *** |
| *DGD* | -0.0005 | -1.52 | -0.0002 | -0.67 |
| *DSCF* | 0.0003 | 0.95 | -0.0005 | -1.42 |
| *MV*AbsRet* | 0.0104 | 9.9 *** | 0.0190 | 16.44 *** |
| *PB*AbsRet* | 0.0016 | 3.51 *** | 0.0017 | 3.59 *** |
| *Coverage*AbsRet* | 0.0058 | 2.5 ** | 0.0107 | 4.47 *** |
| *VolRet*AbsRet* | -0.8844 | -11.74 *** | -0.8383 | -10.33 *** |
| *DGD*AbsRet* | -0.0035 | -0.88 | -0.0016 | -0.37 |
| *DSCF*AbsRet* | 0.0147 | 2.2 ** | 0.0586 | 7.97 *** |
| *QtrD4*AbsRet* | 0.0218 | 6.26 *** | 0.0294 | 8.09 *** |
| *NYSE* | 0.0008 | 2.01 ** | 0.0013 | 3.27 *** |
| *NASDAQ* | 0.0015 | 4.26 *** | 0.0023 | 5.93 *** |
| *N* | | 38,440 | | 38,440 |
| $R^2$ | | 0.1633 | | 0.1828 |
| *F-Test LAnnFct*AbsRet - SAnnFct*AbsRet* | 0.0505 | 20.38 *** | 0.0310 | 3.09 * |

***, **, * significant at 1%, 5%, and 10% level, respectively.

*CAbVol* is cumulative abnormal trading volume during two days of event window (-1, 0) or (1, 2). *SAnnFct* is dummy variables of value one if the number of analyst forecasts at the time of earnings announcement (*AnnFct*) is greater than zero and less or equal to three, zero otherwise; *LAnnFct* is dummy variables of value one if *AnnFct* is greater than four, zero otherwise. All models include year and quarter dummy variables. Please see table 1 for definition of other variables.

**Table 7. Comparison of trading volume reaction to stock price change and analyst forecasts between high consensus and low consensus among analyst forecasts**

$$CAbVol_{j,q} = \alpha_0 + \alpha_1 SAnnFct_{j,q+1} + \alpha_2 LAnnFct_{j,q+1} + \alpha_3 AbsRet_{j,q} + \alpha_4 SAnnFct_{j,q+1} \times AbsRet_{j,q} + \alpha_5 LAnnFct_{j,q+1} \times AbsRet_{j,q} + \alpha_6 MV_{j,q}$$
$$+ \alpha_9 PB_{j,q} + \alpha_7 Coverage_{j,q+1} + \alpha_8 VolRet_{j,q} + \alpha_9 DGD_{j,q} + \alpha_{10} DCF_{j,q} + \alpha_{11} MV_{j,q} \times AbsRet_{j,q} + \alpha_{12} PB_{j,q} \times AbsRet_{j,q}$$
$$+ \alpha_{13} Coverage_{j,q+1} \times AbsRet_{j,q} + \alpha_{14} VolRet_{j,q} \times AbsRet_{j,q} + \alpha_{15} VolRet_{j,q} \times AbsRet_{j,q} + \alpha_{16} DGD_{j,q} \times AbsRet_{j,q} + \alpha_{17} DCFS_{j,q} \times AbsRet_{j,q}$$
$$+ \alpha_{18} QtrD4_{j,q} \times AbsRet_{j,q} + \alpha_{19} NYSE_{j,q} + \alpha_{20} NASDAQ_{j,q} + \sum YearDummies + \sum QuarterDummies + e_{j,q}$$

| Variables | High Consensus | | Low Consensus | | Difference (High – Low) | |
|---|---|---|---|---|---|---|
| | Estimate | t Value | Estimate | t Value | Estimate | t Value |
| *Intercept* | -0.0088 | -1.76 * | 0.0013 | 0.17 | -0.0101 | 0.29 |
| *AbsRet* | 0.2226 | 8.08 *** | 0.1029 | 2.01 ** | 0.1197 | 0.05 ** |
| *lnAnnFct* | 0.0027 | 2.03 ** | 0.0060 | 2.81 *** | -0.0033 | 0.20 |
| *lnAnnFct*AbsRet* | 0.0839 | 9.32 *** | 0.0533 | 3.63 *** | 0.0306 | 0.09 * |
| *MV* | -0.0035 | -10.57 *** | -0.0030 | -5.68 *** | -0.0005 | 0.47 |
| *PB* | 0.0005 | 4.51 *** | 0.0001 | 0.50 | 0.0004 | 0.05 * |
| *Coverage* | 0.0074 | 5.00 *** | 0.0036 | 1.52 | 0.0038 | 0.19 |
| *VolRet* | -0.0521 | -1.67 * | 0.0038 | 0.07 | -0.0559 | 0.39 |
| *DGD* | 0.0025 | 3.11 *** | 0.0025 | 1.77 * | -0.0001 | 0.97 |
| *DSCF* | 0.0046 | 1.83 * | -0.0026 | -0.65 | 0.0072 | 0.14 |
| *MV*AbsRet* | 0.0126 | 5.51 *** | 0.0087 | 2.20 ** | 0.0039 | 0.41 |
| *PB*AbsRet* | 0.0021 | 2.84 *** | 0.0037 | 2.87 *** | -0.0016 | 0.30 |
| *Coverage*AbsRet* | -0.0359 | -3.54 *** | -0.0019 | -0.11 | -0.0340 | 0.10 * |
| *VolRet*AbsRet* | -2.4292 | -17.06 *** | -2.7324 | -10.70 *** | 0.3031 | 0.32 |
| *DGD*AbsRet* | -0.0166 | -2.98 *** | -0.0026 | -0.25 | -0.0140 | 0.26 |
| *DSCF*AbsRet* | -0.0858 | -3.89 *** | 0.0249 | 0.60 | -0.1107 | 0.02 ** |
| *QtrD4*AbsRet* | 0.0278 | 4.43 *** | 0.0483 | 4.37 *** | -0.0205 | 0.12 |
| *NYSE* | 0.0096 | 2.82 *** | 0.0049 | 0.97 | 0.0046 | 0.46 |
| *NASDAQ* | 0.0150 | 4.41 *** | 0.0097 | 1.91 * | 0.0052 | 0.41 |
| *N* | | 25,460 | | 7,970 | | |
| $R^2$ | | 0.2812 | | 0.2685 | | |

***, **, * significant at 1%, 5%, and 10% level, respectively.
Consensus is measured by Barron, et al. (1998), using analysts' announcement forecasts. Firms with consensus value greater (less) than 0.5 is assigned to high (low) consensus sub-sample. *lnAnnFct* is one plus the number of analysts' announcement forecast. All models include year and quarter dummy variables. Please see table 1 for definition of other variables.

windows for stock-return reactions to unexpected earnings and find similar results (untabulated).

In general, we find linear relationship between sensitivity of trading volume reaction to stock price and analyst forecasts when

there is an issuance of analyst forecasts. However, we do not find this relationship when there is no issuance of analyst forecasts. These results provide additional evidence that the observed increase in volume sensitivity to earnings announcements is attributable to analyst announcement period forecasts.

### 4.6. Additional Tests

We use alternative measure uncertainty in analysts' forecasts, consensus measure developed by Barron et al. (1998). Barron et al. measure the consensus by the ratio of analyst dispersion to the mean of the squared error of individual analysts' forecasts. Intuitively, their consensus measure captures the commonality of investors' information, gauged by the correlation of their forecast errors around an assumed expected error of zero. Thus, high consensus in analyst forecasts means the less uncertainty among analysts regarding interpretations of earnings news.

Using analyst forecasts issued at the time of earnings announcement, we measure Barron et al.'s (1998) consensus measure. We use observations of which consensus measure values are between zero and one with a minimum of three analyst forecasts. We assign firms to high (low) consensus sample if consensus value is greater (less) than 0.5. Low consensus means there is more private information different from earnings signal among analyst forecasts. We examine whether trading volume reactions to stock price reactions and compare the magnitude of coefficients between two groups.

Table 7 reports the empirical results. We find that the magnitude of *Intercept* and coefficient on *lnAnnFct* is greater for firms with low consensus sample. These results suggest that on average, those firms with more private information from analysts (low consensus) tend to experience higher trading volume at the time of the earnings announcement. These results are consistent with prior evidence by Barron, Harris, and Stanford (2005). However, consistent with our previous test results, we find that sensitivity of trading volume to stock price changes is greater when there is high consensus in analyst forecasts. These results support that more intensity in analysts' interpretations make investors trade based on earnings news.

Related to our study, Chen, Cheng, and Lo (2010) examine the analyst's interpretation role by examining absolute value of

stock returns around earnings announcement as proxy for total information content of earnings announcement. They assume that magnitude of stock price change reflect the informativeness of earnings announcement. However, Chen et al. consider analysts' forecasting activities around the earnings announcement, excluding analysts' activities at the time of earnings announcement. We focus on the effect of analysts' activities by narrowing down the event window to earnings announcements.

Following Chen et al. (2010), we examine how total magnitude of stock price change is affected by the number of analyst forecasts, using equation (2). As we examine the absolute value of stock price change as dependent variables, we also use the absolute value of unexpected earning to measure the total magnitude of unexpected earnings (*AbsUE*) instead of unexpected earnings (*UE*). We interact *AbsUE* with other control variables. Untabulated empirical results show that the sensitivity of absolute stock price reaction to earnings announcement is greater when more analysts issue forecasts at the time of earnings announcement. The degree to which the number of analysts' announcement forecasts reflects the analysts' information interpreting activities, our evidence provides more direct evidence on the analyst's role of helping investors reflect the information contained in the earnings announcements.

We also change the event window to three days (-1, 1). Previous studies commonly use three day window to examine market reaction to earnings announcement. In general, the results (untabulated) are consistent with previous our findings that return and volume reaction to earnings announcement is increasing with the number of analysts' announcement period forecasts. These results suggest that one of determinants of ERC could be analysts' forecasting activities during the earnings announcement.

## 5. CONCLUSION

This paper provides evidence on how the activities of informed traders affect the market reaction to earnings news by analyzing the relation between the number of announcement period analyst forecasts and the stock price and trading volume reactions to the earnings announcement. Although many studies demonstrate the effect of earnings announcement on stock prices (Lev 1989), there

is little research on the role informed traders play in disseminating information contained in earnings announcements.

Our empirical results show that the trading volume and stock price reaction to new information from earnings announcement increases monotonically with the number of analyst forecasts issued at the time of earnings announcement. We also find that the sensitivity of volume reaction to stock price changes and analyst forecasts is smaller when there is large dispersion in analysts' announcement forecasts. These results suggest that more active trading related to earnings announcements make stock price reflect earnings news more fully. In addition, analysts' interpretations with low uncertainty help investors impound new information contained in earnings reports.

Our study contributes to the extant literature by providing evidence on the role of interpretations. While many analytical studies suggest the potential effect of analysts' activities at the time of earnings announcement on information content of earnings announcement (Kim and Verrecchia 1991b, 1994, 1997), there is little evidence on this issue. Our study suggests that differential market reactions to earnings announcements documented by prior research may be partly attributable to analyst announcement period forecasts. Our study also suggest that analyst forecasts at the time of earnings announcement play the role of interpreting information and help investors incorporate new information from earnings announcement.

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Received February 1, 2013
First Revision Received May 8, 2013
Second Revision Received September 5, 2013
Accepted October 9, 2013