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will discuss

"Evidence That Investors Trade on Private Event-Period Information around Earnings Announcements"

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Evidence That Investors Trade on Private Event-Period Information around Earnings Announcements

Originally by Orie E. Barron, David G. Harris, and Mary Stanford

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Abstract

I replicate Barron, Harris, and Stanford's (2005) "Evidence That Investors Trade on Private-Event-Period Information around Earnings Announcements" which provides empirical support for theoretical models developed in Holthausen and Verrecchia (1990) and Kim and Verrecchia (1997). These model predict that private information generated at the time of an earnings announcement (private event-period information) is associated with greater trading volume. Using analysts as a proxy for investors, Barron et al. (2005) utilize empirical proxies from Barron et al. (1998) to measure increases in private information around earnings announcements and find that announcements that increase analysts' private information are associated with increased trading volume. They also find that announcements that decrease analysts' consensus (i.e. the amount of common information) are associated with increased trading volume, leading them to conclude that, consistent with Kim and Verrecchia's (1997) model, it is possible for public earnings announcements to increase private information and the private information generated in the event-period to spur trading.

I. INTRODUCTION

This paper replicates a study by Barron, Harris, and Stanford (2005) (hereafter BHS) which provides empirical evidence consistent with Holthausen and Verrecchia's (1990) and Kim and Verrecchia's (1997) theoretical models that predict that private event-period information is associated with greater trading volume.

Kim and Verrecchia (1997) introduced the possibility that, contrary to serving as a substitute, public announcements can complement private information, such that public announcements can *increase* private information through the interaction of the public announcement with previously held private information. Typically, this increase in private information occurs as a result of the public announcement increasing the *precision* of the privately held information. Barron et al. (2002) provide an illustration of private event-period information by giving the example of two different analysts with two different sets of private information: One is a Certified Public Accountant who is knowledgeable of the specific effect of accruals on future earnings, and the other is a former political economist who is able to foresee that back-orders from a Brazilian customer will soon decline. In both cases, the analysts are better able to use their private information to forecast future earnings when the private information they hold in the pre-announcement period is combined with reported earnings. Understood in the context of the example, private event-period information can be thought of as a realistic reflection of how private information is utilized in capital markets.

In Beaver's (1968) seminal work, he distinguished trading volume from price reactions, asserting that trading volume reactions capture individual changes in expectations while price reactions reflect wholesale shifts in the expectations of the market. This ability of trading volume to capture individual changes that occur even in the absence of the market as a whole shifting its expectations makes trading volume the necessary measure to use to determine whether private event-period information induces investors to act, since private information in the context of this paper reduces the sort of consensus required for a price reaction.

The development of the theoretical models that form the underpinnings of this paper originate with the fact that trading volume responses were observed empirically even in the absence of price movement. This observation left researchers unsure as to how to interpret trading volume as a market response. Holthausen and Verrecchia (1990) addressed this hesitancy to use trading volume by providing a model that decomposed trading volume into a function of changes in investor informedness and consensus. In their model, increased trading volume in the announcement period could be interpreted as an increase in investor informedness and taken as a signal of the information content of the earnings announcement. However, Holthausen and Verrechia's (1990) conclusions were based upon the assumption that a public earning announcement should increase consensus, not incorporating the notion alluded to in Beaver (1968) and developed more formally in Karpoff (1986) that high volume was associated with heterogeneous investor response.

Kim and Verrecchia (1991) were able to explain how a public earnings announcement could engender a heterogeneous response within a rational market framework by building a model of trading volume based upon private information obtained in the pre-announcement period. In their model, the private nature of investors' pre-announcement information explained the differing precision of information held by individual investors. By causing investors to revise their beliefs from different starting points in the pre-announcement period, the differing precision of their pre-announcement period information would lead to a heterogeneous response to an earnings announcement. While a step forward towards developing a more comprehensive model of announcement period trading volume, this model failed to provide a rational market explanation for a decrease in consensus after a public earnings announcement, as is observed in 63.6% of my sample.

Kim and Verrecchia (1997) refined their model of private information by introducing the concept of private event-period information. Since private event-period information could also be of differing precision, private event-period information provided a rational explanation for why investors could reach different conclusions about the firm value after the release of a public earnings announcement.

Prior to BHS, there had been other empirical research that utilizing trading volume as a dependent measure to capture disagreement or the heterogeneity of investor response. However, the proxies for disagreement, most notably analyst forecast dispersion as used in Ziebart (1990), failed to distinguish between the trading volume effect of increases in uncertainty and decreases in consensus. Other researchers had used measures of dispersion to measure the information environment either in anticipation (such as Atiase and Bamber [1994]) or in the wake of disclosures, but none prior to BHS had looked at *both* the pre-disclosure and the event-period. However, Bamber et al. (1997), in attempting to explain their result that differential forecast revisions led to higher trading in the event-period, posited that differing precision of pre-disclosure information between individual investors could be the cause. This paper filled a gap in the extant literature by linking the pre-disclosure results observed in Ataise and Bamber (1994) and the event-period results observed in Bamber et al. (1997) using theoretical frameworks developed by Holthausen and Verrecchia (1990) and Kim and Verrecchia (1997).

The remainder of this paper is organized as follows: Section II describes the two theoretical models that provide the framework for the development of the hypotheses tested in this paper. Section III specifies the empirical models used and how the variables were measured while providing a comparison to the designs used in similar research. Section IV details the methodology used to recreate the sample for testing. Section V discusses the results. Section VI concludes the paper.

II. HYPOTHESIS DEVELOPMENT

The theoretical work of Kim and Verrecchia (1997) provide much of the motivation and basis for the two hypotheses tested by BHS. In their paper, Kim and Verrecchia (1997) introduce the concept of private event-period information, defined as the use of pre-announcement private information in conjunction with a public information event such as an earnings announcement to create new private information that can only be acted upon in the event-period. Previous to Kim and Verrecchia (1997), work that modeled the effect of information on trading volume looked exclusively at information in either the pre-announcement period or the event period[1]. Since private event-period information represents new information, it has its own precision which can vary from investor to investor, distinct from the precision of private pre-announcement information. Thus, Kim and Verrecchia (1997) provided a rational market explanation for disagreement about stock price occurring after a public announcement.

[1] An exception is Dontoh and Ronen (1993). However, Kim and Verrecchia (1997) point out that Dontoh and Ronen's model was flawed by assuming that the precision of private information was identical across investors and that, in the pre-announcement period, all investors share a common error term in their private assessments of firm value.

In their model, trading volume is a function of both the precision of private pre-announcement information and private event-period information. Although differing precisions of private event-period information can explain disagreement about stock price after a public announcement, Kim and Verrecchia (1997) find that private event-period information causes trading volume even if its precision is identical across all investors. The trading volume effect of private event-period information occurs in Kim and Verrecchia's (1997) model even when private pre-announcement information is of identical precision for all investors or is non-existent and in the absence of an accompanying price change. Therefore, BHS and I expect to find higher trading volume in firm quarters with greater private event-period information, even after controlling for returns and the precision of private pre-announcement information.

Holthausen and Verrecchia (1990) explained announcement period trading volume as a function of informedness and consensus, such that if the other is held constant increased informedness leads to increased trading volume and increased consensus leads to decreased trading volume. If private event-period information is understood as increasing informedness and decreasing consensus, then BHS and I expect that the presence of private event-period information will lead to decreased consensus that is associated with increased trading volume, even after controlling for returns and the precision of private pre-announcement information. Accordingly, BHS state the hypotheses as follow below:

H1: Earnings announcement "residual" trading volume that is unexplained by price changes or differential pre-disclosure private information is positively associated with private event-period information.

H2: Earnings announcement "residual" trading volume that is unexplained by price changes or differential pre-disclosure private information is negatively associated with changes in consensus.

III. RESEARCH DESIGN

Quarterly earnings announcements provide an ideal event to examine the interaction of public and private information by analyzing their effect on analysts' forecasts of annual earnings. Building off of work by Barron (1995) and Barron et al. (1998) that use properties of analyst forecasts to develop proxies that measure analysts' information environment, BHS make inferences about the presence of private event-period information by comparing the properties of those forecasts before and after the announcement. The following model is used to test H1:

$$EXVOL_j = a_0 + a_1 \Delta PPRECISION_j + a_2 LARETURN_j + a_3 LJUMBLING_j + e_j \quad (1)$$

where:

$EXVOL_j$ = the excess trading volume attributable to the earnings announcement period, defined as the natural log of the cumulative trading volume for a three-day window centered on the earnings announcement date [-1, +1] minus the natural log of the median trading volume for the firm for the year (249 trading days) prior to the earnings announcement period window and j is the firm-quarter subscript;

$\Delta PPRECISION_j$ = a continuous variable that represents the change in the PPRECISION measure (as defined below) from the pre-announcement period [-45, -1] to the post-announcement period [0, +30];

$LARETURN_j$ = the natural log of the absolute value of the firm's cumulative raw return for the announcement-period window [-1, +1];

$LJUMBLING_j$ = the natural log of 1 minus the Pearson correlation between the annual earnings forecasts issued in the pre-announcement period window and the annual forecasts issued by the same analyst in the post-announcement period window; and

e_j = the error term for firm-quarter *j*.

For the purposes of this paper, private event-period information is only observed with regard to consensus when it is decreasing. Therefore, private event-period is also measured using an indicator variable which is set to 1 when consensus decreases in addition to using a continuous variable for the change in consensus. Accordingly, the models used to test H2 are as follows:

$$EXVOL_j=b_0+b_1 CONNEG_j+b_2 LARETURN_j+b_3 LJUMBLING_j+e_j \quad (2)$$

$$EXVOL_j=c_0+c_1 \Delta CONSENSUS_j+c_2 LARETURN_j+c_3 LJUMBLING_j+e_j \quad (3)$$

where $EXVOL_j$, $LARETURN_j$, $LJUMBLING_j$, and e_j are as defined above, and;

$CONNEG_j$ = an indicator variable equal to 1 if the *CONSENSUS* measure declined from the pre-announcement period to the post-announcement period, or to 0 otherwise; and

$\Delta CONSENSUS_j$ = a continuous variable that represents the change in the *CONSENSUS* measure (as defined above) from the pre-announcement period to the post-announcement period.

Dependent Variable

When using trading volume as a dependent measure, it is critical to eliminate the effect of liquidity trading which is not related to news. Liquidity or noise trading is proxied by the median rather than the mean value of trading volume for the preceding year, since trading volume tends toward a log-normal distribution. This positive skewness in the distribution of trading volume (as is evident in the descriptives of *VOL* in Table 1) also explains the choice by BHS to use a natural log transformation of their excess volume measure.

Empirical Proxies for Private Event-Period Information and Consensus

Three assumptions form the basis of the private event-period information proxies used in this paper. The first is that any increase in information, whether public or private, will result in a more accurate forecast and conversely, that any increase in accuracy must be attributable to an increase in information. The second assumption is that increases in accuracy that are accompanied by decreases in dispersion are assumed to be due to common or *public* information. From the second assumption, it follows that increases in accuracy that are accompanied by greater dispersion are assumed to be due to non-public or *private* information.

The third and last assumption is that changes in accuracy and dispersion measured around an event, in this case, a quarterly earnings announcement, are attributed to that event.

The two measures used to capture private event-period information incorporate dispersion and accuracy in different manners to reflect the models upon which they are based. Extrapolating from Holthausen and Verrecchia (1990), decreases in consensus that are accompanied by increases in informedness caused by private information should lead to increased trading volume. BHS's definition of consensus follows from the first two assumptions given above[2]:

$$CONSENSUS = 1 - \frac{D}{V} \tag{5}$$

where:

D represents dispersion in analysts' forecasts, measured as $\sum_{i}^{n} (FC_i - \overline{FC})^2/(n-1)$ (the sample variance for the forecasts), where n = the number of forecasts; and

V is the mean of the squared differences between individual analysts' forecasts (FCi) and the realization of those forecasts, the reported earnings per share (EPS), measured as

$$\sum_{i}^{n} (FC_i - EPS)^2/n .$$

In Kim and Verrecchia (1997), excess trading volume caused by private event-period information arises due to differences in its precision, where precision is defined as the inverse of the variance. If *CONSENSUS* is thought of as a measure of the presence of private

[2] Equation numbers match those in BHS and thus may not be sequential.

information (information that increases accuracy while increasing dispersion), then the precision of private information (*PPRECISION*) can be expressed as:

$$PPRECISION = (1 - CONSENSUS) \cdot \left(\frac{1}{V}\right) = \frac{D}{V^2} \quad (4)$$

where D and V are as defined above.

D/V and, by extension, *CONSENSUS* are constrained to the range between 0 and 1, excepting the improbable case where all forecasts are exactly equal to the realization, in which case D/V would be infinite. Otherwise, the extreme value of D/V equaling 0 (*CONSENSUS*=1) occurs when all forecasts are exactly the same, such that all forecasts equal the mean forecast ($\overline{FC}$). If the number of forecasts (*n*) is large, D/V will approach 1 (*CONSENSUS*=0) when the mean forecast equals the realization (as denoted by EPS).

While *CONSENSUS* and *PPRECISION* appear similar, they represent different constructs. Conceptually, consensus as a construct can decline either because the amount of private information has increased or the amount of common information has decreased. However, a change in the amount of common information will not affect the precision of private information meaning that an increase in the precision of private information can only be the result of an increase in the accuracy of private information[3]. While conceptually a decline in consensus can be attributed to a decrease in the amount of common information, since BHS examines changes in *CONSENSUS* around an earnings announcement, they assume

[3] To illustrate this using their constructed variable, BHS use the example of the unlikely case where each individual analyst's forecast accuracy (1/V) is held constant for the pre- and post-periods. If the relative degree to which information is private (D/V) increases, then holding individual forecast accuracy constant will result in the mean forecast moving closer to realized earnings. Thus, they conclude that increases in private information will always result in some type of increase in accuracy, whether due to more accurate individual forecasts, a more accurate mean forecast, or both.

that observed decreases in *CONSENSUS* can be credited safely to an increase in the amount of private information, which is supported by the strong and highly significant correlations between ranked Δ*PPRECISION* and Δ*CONSENSUS* and *CONNEG* (See Table 1).

Control variables

LARETURN is calculated using raw returns as opposed to market adjusted returns, mirroring the use of absolute price change as an influencing factor in both Kim and Verrecchia's (1997) and Holthausen and Verrecchia's (1990) models of trading volume. It also mirrors the construction of the *EXVOL* variable, which is not adjusted for market-wide volume. From an empirical perspective, *LARETURN* controls excess event-period trading volume for the news content of the earnings announcement, eliminating the need to adjust the excess volume measure for prior news events in the measurement period.

Calculated as the natural log of the compliment of the Pearson correlation between the individual pre- and post-announcement forecasts, *LJUMBLING* is a function of the correlation over time between pre- and post-forecasts and represents the extent to which the relative positions of individual forecasts within the entire distribution of forecasts have changed because of the earnings announcement. The use of the compliment of the Pearson correlation allows increases in *LJUMBLING* to reflect increases in the amount of belief revision occurring around the earnings announcement.

The inclusion of *LJUMBLING* is BHS's attempt to isolate the effect of private event-period information by controlling for trading volume reaction attributable to differences in the precision of pre-announcement period private information held by individual analysts. Bamber et al. (1997) argue that jumbling is a better measure of disagreement than measures based on dispersion. If expectations formed using private event-period information have their antecedents in pre-announcement private information, then from a rational market perspective, the likely source for an increase in disagreement around the earnings announcement would be differences in the precision of pre-announcement information. From a non-rational market perspective, Kandel and Pearson (1995) note that jumbling may be due to investors using identical information to irrationally develop different expectations. In any case, *LJUMBLING* controls for belief revision that is not captured by the private event-period information creation proxies. An example of what Bamber et al. (1997) call forecast "flipping" provides an illustration of a situation where belief revision has occurred but neither *PPRECISION* nor *CONSENSUS* would change. Prior to the earnings announcement, Analyst A issues an annual EPS forecast of $1.20 and Analyst B issues a forecast of $1.17. After the announcement, Analyst A revises her forecast to $1.17 while Analyst B revises his forecast to $1.20. In this situation, neither the dispersion [D] nor accuracy [V, the variance of forecast errors] of the forecasts overall has changed, but belief revision has undoubtedly occurred. It is theoretically possible that belief revision associated with *LJUMBLING* also captures the creation of private event-period information; however, the lack of correlation between *LJUMBLING* and the three private event-period information proxies (Ranked Δ*PPRECISION*, Δ*CONSENSUS*, and *CONNEG*, see Table 1) seems to indicate that *LJUMBLING* represents a distinct construct.

BHS takes much of their research design from Bamber et al. (1997) with both using the same windows to define the pre- and post-announcement periods and both requiring a minimum of five analysts issuing and revising for inclusion in the sample. However, BHS make one minor alteration. By using announcement period returns as their control variable for the quarterly earnings surprise contained within the announcement, substituting it for the earnings surprise control variable calculated by Bamber et al. (1997) using quarterly earnings forecasts, BHS is able to simplify their calculation of abnormal volume, eliminating the need to separate the effect of previous earnings announcements from their measure of abnormal volume as was done in Bamber et al. (1997). Thus, for their measure of abnormal trading volume, the "normal" level of trading volume is defined as the median three day cumulative volume for the year leading up to the earnings announcement event window, as determined by splitting the 249 trading days prior to Day -1 (where day 0 is the date of the quarterly earnings announcement as reported in Compustat) into 83 contiguous three day periods, which includes other earnings announcement periods, unlike Bamber et al. (1997) which specifically excludes three day windows that include a prior quarter's earnings announcement when determining the median trading volume. Another advantage of including returns as a control variable is that it also controls for other value relevant news-related trading which is an admitted limitation of the design of Bamber et al. (1997) as discussed in footnote 18 in their paper in that they excluded other earning announcements but not other possible price-relevant information events when determining "normal" trading volume.

IV. SAMPLE AND DATA USED

The sample used in BHS consisted of firm-quarter observations occurring between the first quarter of 1984 and the third quarter of 1996. Firm quarters included in the sample had to meet the following criteria:

(1) The quarterly (interim) earnings announcement date was available on the quarterly Compustat fundamental quarterly file;

(2) Five or more individual analysts on I/B/E/S issued an annual earnings forecast within the 45 days prior to the quarterly earnings announcement **and** a revised annual forecast within a 30-day post-announcement window (both the pre-announcement window forecast and the post-announcement forecasts can be attributed to the identical analyst code); and

(3) Trading volume, stock return and size (market value of equity) information are available for the required dates on the CRSP Annual Daily Securities File.

Because BHS limited themselves to firms with volume and return data from CRSP's NYSE, AMEX, and NASDAQ files for condition (3), I used the I/B/E/S EPS for the US Region Detail File with Actuals to determine which firm quarters met criteria (2). In addition, to avoid small denominator problems in the tests, I followed BHS by deleting firm quarters for which the mean annual EPS forecast (including both pre-announcement forecasts and post-announcement revisions) or the realized annual EPS was less than 0.10 in absolute value, yielding a final sample of 2,661, smaller than BHS's final sample of 2,724 which is likely due to subsequent deletions of analyst forecasts from I/B/E/S, causing a number of firm quarter to fall below the inclusion threshold of five forecasts and revisions.

By far, criteria (2) was the most limiting, but the requirement of a minimum of five forecasts and revisions from the same analysts was necessary to ensure a sufficient sample to assess the *PPRECISION* and *CONSENSUS* measures and the related change variables for each announcement period. It was also important to keep the pre-announcement and post-announcement windows relatively short to ensure that the pre and post measures of consensus were based on recent forecasts, such that the dispersion of forecasts captured by the measures used represent a lack of common information, as opposed to stale information, and that the changes in consensus from the pre to the post period are primarily due to the quarterly earnings announcement. However, criteria (2) precludes firms with an analyst following of less than five, and the frequency of forecasts and revisions requirement leads the sample to be dominated by large firms with large quarterly earnings surprises.

Table 1 presents the descriptive statistics for the sample, which are consistent with the sample in BHS. As discussed above, the firms included in my sample are rather large. The mean (median) size of sample firms as measured by the market value of their equity is $6,973 ($2,913) million. The mean (median) absolute return (*ARETURN*) for the three days surrounding the quarterly earnings announcement is 0.044 (0.030) which is consistent with the earning announcement containing a large earnings surprise.

For descriptive purposes, mean, median, and 25th and 75th percentile information is given for overall announcement period trading volume (*VOL*) as well as for the variables of interest, the natural log-transformed abnormal or residual trading volume (*EXVOL*) and the change from the pre to post announcement period windows both for the private information precision and the consensus measures (Δ*PPRECISION* and Δ*CONSENSUS*). Descriptives are also supplied for the transformed variables used in the regressions, the natural log of the absolute return (*LARETURN*), the ranked change in precision (Ranked Δ*PPRECISION*), the dummy variable used to indicate whether or not the proxy used to analysts' consensus declined from the pre to the post announcement period (*CONNEG*), and the natural log of the belief jumbling measure (*LJUMBLING*). The mean (median) of the untransformed jumbling variable for the sample is 0.547 (0.439), comparable to the 0.477 (0.589) that Bamber et al. (1997) reported using a similar sample.

The descriptive statistics are comparable to BHS, indicating that the sample used for testing was substantially similar to the one used by BHS. Reviewing some of the more noteworthy variable characteristic, I find, as did BHS, that *EXVOL*, does not display the same degree of positive skewness as *VOL*. In contrast to *CONSENSUS* which is restricted to falling between -1 and 1, the definition of *PPRECISION* leaves it unbounded, and it can be seen in Table 1 from the mean of 1,698.28 and median of 1.807 for Δ*PPRECISION* that the sample is affected by extreme values. However, my mean and median are lower than the 278,647 and 16.5 found by BHS. BHS resolved the lack of normalcy in the Δ*PPRECISION* variable by regressing the ranked Δ*PPRECISION* variable to test H1. The mean and median values of 474.64 and 468 for the ranked Δ*PPRECISION* variable are not equal because Δ*PPRECISION* was ranked by quarter and there were not an equal number of observations for the quarters (789 occurred in a Q1, 815 in a Q2, and 1,057 in a Q3). The mean of *CONNEG* (0.636) equals the percentage of observations where consensus declined following the earning announcement.

Because this paper purports to measure the creation of private event-period information by individual analysts as opposed to overall analyst disagreement, when calculating the analyst forecast related variables (*CONSENSUS*, Δ*CONSENSUS*, *CONNEG*, *PPRECISION*, Δ*PPRECISION*, *LJUMBLING*), only those analysts who issued at least one forecast within both the pre and post announcement windows were included. When calculating the *LJUMBLING* variable, if an analyst made multiple forecasts within the pre or post announcement window, the latest pre-announcement forecast and/or the earliest post announcement forecasts were used. *CONSENSUS* and *PPRECISION* were calculated separately for each firm quarter's pre and post announcement windows using the formulas given in Equations (4) and (5) where D = the sample variance of the included forecasts and V =

the mean of the squared forecast errors (measured against the realization of the annual EPS forecast).

Returns were calculated for the *LARETURN* measure by taking the absolute value of the cumulative raw returns for the three day event window. Raw returns were used to parallel the *EXVOL* measure, which, for the main results, was not adjusted for overall market activity during the announcement period.

V. FINDINGS

Pairwise Correlations

The Spearman (above diagonal) and Pearson (below diagonal) correlations among the variables used in the analysis are presented in Table 2. Similar to BHS, the change in consensus (Δ*CONSENSUS*) is negatively correlated to excess trading volume. Accordingly, the correlation between excess volume and *CONNEG*, an indicator variable set equal to one when Δ*CONSENSUS* is negative, is positive and highly significant. I also found that the correlation between excess trading volume and the ranked change in the precision of analysts' private information was significant. These correlations are consistent with expectations based upon theoretical models by Holthausen and Verrecchia (1990) and Kim and Verrecchia (1997) that indicate that the creation of private event-period information leads to increased trading volume. The three different measures of private event-period information creation (Ranked Δ*PPRECISION*, *CONNEG*, or Δ*CONSENSUS*) are also significantly correlated with one another and in the expected directions, providing support that the three variables proxy the same construct.

The correlations between excess volume and the two control variables, the natural log transformed absolute announcement period return (*LARETURN*) and the natural log transformed belief jumbling measure (*LJUMBLING*), are both positive and significant, supporting their inclusion as control variables. While *LARETURN* serves to control for trading volume due to the information content of the earnings announcement, *LJUMBLING* controls for excess trading volume triggered by disagreement unrelated to the creation of private event-period information, which is corroborated by the lack of significant correlation between *LJUMBLING* and any of the proxies that represent the creation of private event-period information (Ranked Δ*PPRECISION*, *CONNEG*, or Δ*CONSENSUS*). From a rational market perspective, BHS argue that *LJUMBLING* captures analyst disagreement caused by "differential precision of private pre-disclosure information." In any case, the positive, significant correlation between LJUMBLING and LARETURN is consistent with the notion that the jumbling measure captures belief revision and with Kim and Verrecchia's (1991) precursor model where belief jumbling moves in concert with price changes and trading volume.

Results of Hypothesis Tests

The results from the test of H1 using the model given in Equation (1) are reported in Table 3. While small (9.84×10^{-5}), the coefficient on Δ*PPRECISION* is positive and significant (one-sided p-value 0.0057) as predicted by H1. Δ*PPRECISION* is positive and significant even with the inclusion of *LARETURN* and *LJUMBLING* which are both significant (p-values of <.0001 and .0044, respectively), indicating that private event-period information provides an incremental trading volume effect above and beyond that due to price change or differences in the precision of pre-announcement private information between agents. The coefficients on control variables are also both positive (0.150 for *LARETURN* and 0.021 for *LJUMBLING*), which is consistent with expectations based upon Kim and Verrecchia's (1997) and (1991) models as well as prior empirical research (Bamber et al. 1997). The results from the test of H1 suggest that earnings announcements that increase analysts' private information through the creation of private event-period information are associated with increased trading volume, consistent with investors experiencing a similar increase in private information due to private event-period information.

The results for the tests of H2 are reported in Table 4 using the two different measures of declines in consensus as given in Equations (2) and (3). The coefficient on the measure of decreasing consensus in Equation (2), the indicator variable *CONNEG,* is positive (0.087) and significant (p-value of 0.0001). *CONNEG* is significant even with the inclusion of the control variables, *LARETURN* and *LJUMBLING*, indicating that earnings announcements that decrease consensus among analysts are associated with a higher level of trading volume than those that increase consensus. *LARETURN* and *LJUMBLING,* as in the test of H1, both have positive, significant coefficients as expected (0.149, p-value of <0.0001 and 0.022, p-value of 0.0036, respectively). In my estimation of Equation (3), the coefficient on the measure of decreasing consensus, the continuous variable Δ*CONSENSUS,* is negative (-0.015) as expected and as found by BHS. However, unlike BHS, I did not find Δ*CONSENSUS* to be significant (p-value 0.0557). The coefficients for the control variables *LARETURN* and *LJUMBLING* in the estimation of Equation (3) are similar to those found in the estimation of Equation (2) with similar significance. The coefficient estimates for *LARETURN* and *LJUMBLING* in Equation (3) are 0.150 (p-value <0.0001) and 0.021 (p-value 0.0037), respectively. Although I did not find significance for the continuous measure of change in *CONSENSUS*, taking the results for both tests of H2 together, I find support for the association between a decline in consensus and an increase in trading volume consistent with the creation of event-period private information that causes to trade based upon differing opinions on the appropriate value of the stock.

VI. CONCLUSION

The findings in this paper provide empirical support for the theoretical model of announcement period trading volume developed by Kim and Verrecchia (1997). Their model predicted that private information generated at the time of an earnings announcement or private event-period information is associated with greater trading volume, even in the absence of an announcement period price change. Utilizing changes in dispersion and accuracy in analyst forecasts around the earnings announcement date to develop proxies for private event-period information based upon the work of Barron et al. (1998), I am able to substantially replicate the findings of Barron et al. (2005) that private event-period information is positively associated with trading volume.

The presence of private event-period information is both through an increase in the precision of private information and through a decrease in consensus around the earnings announcement date. In both cases, changes consistent with the creation of private event-period information (increases in the precision of private information or a decrease in consensus) were found to be significantly related to increased trading volume. This relationship was significant even after controlling for the earnings surprise (as measured by the price response to the earnings announcement) and belief jumbling around the earnings announcement date, both of which have been shown in prior literature to be associated with increased trading volume.

I selected this paper because I wanted to gain exposure to working with trading volume and gain experience using the properties of analyst forecasts to make inferences about the information environment for investors. Replicating this paper gave me the opportunity to review the literature on trading volume and to consider how the different properties of analyst forecasts can be used to proxy for different constructs. In addition, reading the analytical papers that form the theoretical basis for this paper exposed me to the concept that variation in investor response unrelated to risk can occur and still be consistent with a rational market framework, particularly when there is differential precision in private information.

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TABLE 1
Descriptive Statistics for a Sample of 2,661 Interim Earnings Announcements over the Period 1984 to 1996[a]

Variable	Mean	25th Percentile	Median	75th Percentile
VOL (% traded)	0.027	0.007	0.014	0.029
EXVOL	0.431	0.026	0.398	0.804
Δ*PRECISION*	1,698.28	7.31×10^{-5}	1.807	71.281
CONNEG	0.636	0	1	1
Δ*CONSENSUS*	-0.143	-0.273	-0.036	0.03
Ranked Δ*PRECISION*	474.64	237	468	697
Control Variables				
ARETURN	0.044	0.013	0.030	0.058
LARETURN	-3.732	-4.339	-3.510	-2.855
LJUMBLING	-1.067	-1.619	-0.823	-0.231
SIZE ($ millions)	$6,973	$1,165	$2,913	$7,067

[a] Each interim announcement has at least five analysts' forecasts of annual earnings updated within 45 days before the quarterly (interim) announcement, with the same five analysts updating within 30 days after the announcement.

Variable Definitions:

VOL = the percent of outstanding shares traded over the three-day event window (days -1 to +1 relative to the quarterly earnings announcement date);

EXVOL = event-period induced excess trading volume, defined as the natural log of the cumulative trading volume over the three-day event window (days -1 to +1 around the interim earnings announcement) minus the natural log of the firm-specific median trading volume, where median volume is defined as the median amount of volume for contiguous three-day periods over the 249 trading days prior to the earnings

Δ*PRECISION* = a continuous variable measuring changes in the BKLS proxy for the precision (or amount) of analysts private information;

CONNEG = an indicator variable set to 1 if the BKLS rpoxy for analysts' consensus declined around the earnings announcement, and 0 otherwise;

Δ*CONSENSUS* = a continuous variable measuring changes in the BKLS proxy for analysts' consensus around the earnings announcement, and 0 otherwise;

ARETURN = the absolute value of the sum of a firm's daily returns in the three-day event window;

LARETURN = the natural log of the absolute value of the sum of firm's daily returns in the three-day event window;

LJUMBLING = the natural log of 1 minus the Pearson correlation between the annual earnings forecasts issued by individual analysts in the 45 days before the interim earnings announcement and the annual earnings forecasts issued by the same analysts within the 30 days after the interm earnings announcement; and

SIZE = market value of equity; measured six days prior to the three-day event window.

TABLE 2

Spearman (above diagonal) and Pearson (below diagonal) Correlations among Excess Trading Volume, Ranked Change in Private Event-Period Information, Declines and Changes in Analysts' Consensus, and Control Variables[a]

(n = 2,661; p-values in parentheses)

Variable	***EXVOL***	**Ranked *ΔPRECISION***	***CONNEG***	***ΔCONSENSUS***	***LARETURN***	***LJUMBLING***
EXVOL		0.059	0.086	-0.042	0.345	0.069
		(0.0025)	(< 0.0001)	(0.0291)	(< 0.0001)	(0.0004)
Ranked	0.063		0.565	-0.236	0.035	0.013
PRECISION	(0.0012)		(< 0.0001)	(< 0.0001)	(0.0737)	(0.5088)
CONNEG	0.089	0.580		-0.207	0.049	-0.006
	(< 0.0001)	(< 0.0001)		(< 0.0001)	(0.0123)	(0.7662)
ONSENSUS	-0.078	-0.691	-0.833		-0.024	0.012
	(0.0001)	(< 0.0001)	(< 0.0001)		(0.2196)	(0.5377)
LARETURN	0.406	0.047	0.070	-0.059		0.048
	(< 0.0001)	(0.0157)	(0.0003)	(0.0024)		(0.0124)
LJUMBLING	0.062	-0.005	-0.022	0.011	0.054	
	(0.0013)	(0.7871)	(0.2507)	(0.5699)	(0.0056)	

[a] Table 1 describes the sample and variables.

TABLE 3

Rank Regression of Excess Trading Volume around Quarterly Earnings Announcements on Changes in the Precision of Analysts' Private Information and Control Variables

(n = 2,661)

Variable[a]	**Expected Sign**	**Coefficient (p-value)**
Intercept		0.967 (< 0.0001)
Ranked Δ*PRECISION*	+	9.84×10^{-5} (0.0057)[b]
LARETURN	+	0.150 (< 0.0001)
LJUMBLING	+	0.021 (0.0044)
Adjusted R^2	12.26%	

[a] The notes to Table 1 describe the sample and variables.

[b] One-sided p-value

TABLE 4
Regression of Excess Trading Volume around Quarterly Earnings Announcements on Changes and Declines in Analysts' Consensus, and Control Variables
(n = 2,661)

Variable[a]	**Expected Sign**	**Coefficient (p-value)**	
		Eq. (2)	Eq. (3)
Intercept		0.956	1.013
		(< 0.0001)	(< 0.0001)
CONNEG	+	0.087	
		(0.0001)	
Δ*CONSENSUS*	-		-0.015
			(0.0557)
Controls:			
LARETURN	+	0.149	0.150
		(< 0.0001)	(< 0.0001)
LJUMBLING	+	0.022	0.021
		(0.0036)	(0.0037)
Adjusted R^2		12.54%	12.17%

[a] The notes to Table 1 describe the sample and variables.