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Asymmetric Timeliness and the Resolution of Investor Disagreement and Uncertainty at Earnings Announcements

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ABSTRACT: This study finds that greater asymmetric timeliness of earnings in reflecting good and bad news is associated with slower resolution of investor disagreement and uncertainty at earnings announcements. These findings indicate that a potential cost of asymmetric timeliness is added complexity from requiring investors to disaggregate earnings into good and bad news components to assess the implications of the earnings announcement for their investment decisions. Such a disaggregation impedes the speed with which investor disagreement and uncertainty resolve. The findings indicate that asymmetric timeliness also delays price discovery at earnings announcements. We also find a positive relation between asymmetric timeliness and stock returns during the earnings announcement period after the initial price reaction to the announcement, which is consistent with resolution of valuation uncertainty. However, we do not find clear evidence of more net stock purchases during this period by insiders of firms with greater asymmetric timeliness.

JEL Classifications: M41; G14.

Keywords: conditional conservatism; earnings announcements; information content.

I. INTRODUCTION

The question this study addresses is whether greater asymmetric timeliness of earnings in reflecting good and bad news (hereafter, asymmetric timeliness) is associated with slower resolution of equity investor disagreement and uncertainty at earnings announcements. Asymmetric timeliness of earnings, which is purported to arise from conditionally conservative recognition of economic events in earnings, is evidenced by a larger coefficient for negative return than for positive return in the earnings-return regression (Basu 1997).[1] It is a widely documented empirical regularity. We predict and

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[1] For ease of exposition, we use the term "asymmetric timeliness" rather than "conditional conservatism" to refer to good news recognized in earnings on a less timely basis than bad news. We make no conceptual distinction between the two terms. For the sake of parsimony, when we refer to conservatism in the context of asymmetric timeliness, we mean conditional conservatism.

find evidence that earnings exhibiting greater asymmetric timeliness is associated with slower resolution of equity investor disagreement and uncertainty at earnings announcements, as well as with delayed price discovery.

The benefits of asymmetric timeliness to equity- and debtholders have been broadly discussed and documented in the literature.[2] The pervasiveness of asymmetric timeliness suggests that these benefits generally exceed any costs. However, the literature also documents that asymmetric timeliness varies across firms and industries and over time. This variation suggests that firms face different benefits and costs associated with asymmetric timeliness. Yet there is little research on these costs. We posit that one potential cost of asymmetric timeliness is that it increases the time it takes investors to assess the implications of the earnings announcement for their investment decisions, which results in slower resolution of equity investor disagreement and uncertainty at the earnings announcement.

When earnings is announced, each investor assesses whether the information in announced earnings alters the investor's desired holding of the firm's shares. Earnings comprising components with different implications for investors' investment decisions, i.e., whether to buy, hold, or sell the firm's shares and at what price, adds complexity to the assessment tasks. This is because investors must disaggregate earnings into these components in making their investment decisions. Asymmetric timeliness adds to this complexity because when earnings is asymmetrically timely, investors must also determine whether the firm's earnings relates to good or bad news. Moreover, greater asymmetric timeliness results in larger differences between good and bad news in the implications of earnings for investment decisions. Complexity results in information processing delays, and creates potential for investor disagreement and uncertainty, both of which take time to resolve. Thus, we expect that greater asymmetric timeliness is associated with increased complexity of earnings and, therefore, slower resolution of equity investor disagreement and uncertainty at earnings announcements. Although earnings complexity could arise from other sources, we focus on asymmetric timeliness because of its pervasiveness in financial reporting and, consequently, in the accounting academic literature.

We address our research question by developing a measure of asymmetric timeliness based on the Basu (1997) asymmetric timeliness coefficient that varies cross-sectionally and intertemporally. We then test whether the measure has a significantly negative relation with measures reflecting the speed with which investor disagreement and uncertainty at earnings announcements resolve. Finding a negative relation implies that investor disagreement and uncertainty resolve more slowly for firms with higher levels of asymmetric timeliness. As with all association studies, including those documenting benefits of asymmetric timeliness, we cannot rule out the possibility that this finding could be attributable to another source of complexity. For example, if asymmetric timeliness is positively associated with another source of complexity, slower resolution of investor disagreement and uncertainty for firms with greater asymmetric timeliness could be attributable to the association of asymmetric timeliness with the other source of complexity rather than to complexity added by asymmetric timeliness. The relation between asymmetric timeliness and other sources of complexity remains an open empirical question.

To develop our measure of asymmetric timeliness, we use a latent class model to group observations within each year into homogeneous classes with respect to their asymmetric timeliness coefficients. The latent class model allows for the possibility that different groups of firms have different asymmetric timeliness coefficients and identifies these groups. Whereas prior studies pre-specify the firm characteristics that result in variation in the asymmetric timeliness coefficient, using a latent class model does not require this pre-specification. Instead, the model identifies homogeneous classes of observations with respect to the asymmetric timeliness coefficient by maximizing the log-likelihood function of normally distributed residuals through iterative simultaneous determination of coefficients of the Basu (1997) equation for each class, the number of homogeneous classes, and the observations that belong to each class.

Our speed of resolution measures are based on two commonly employed measures of investor disagreement and uncertainty: equity trading volume and return volatility. Because our focus is on the speed of resolution—not the amount—of investor disagreement and uncertainty, we measure the proportions of trading volume and equity return volatility in the days immediately surrounding the announcement to those in the full announcement period. Specifically, our measures are the ratios of the sums of daily volume and volatility during the initial earnings announcement period to those in the full announcement period. We define the initial period as the four days beginning one day before the annual earnings announcement, i.e., day -1 to day 2 relative to the earnings announcement. We define the full period as the 22 days beginning one day before the annual earnings announcement, i.e., day -1 to day 20, by which time we expect any investor disagreement and uncertainty associated with the earnings announcement to be resolved. Higher (lower) ratios indicate that investor disagreement and uncertainty resolve more quickly (slowly) because higher (lower) ratios indicate that more (less) of the full announcement period disagreement and uncertainty occur in the initial announcement period.

We test our predictions using a sample of 24,310 annual earnings announcements associated with fiscal year-ends from 1994 to 2011. The findings from our tests are consistent with the prediction that asymmetric timeliness is significantly

[2] See Section II for a more detailed discussion of, and cites to, related literature.

negatively related to both resolution measures. These findings indicate that asymmetric timeliness is associated with slower resolution of investor disagreement, as reflected in trading volume, and more time for average investor beliefs to update fully, as reflected in equity volatility. Our findings suggest that a one-standard-deviation increase in our asymmetric timeliness measure is associated with a decrease in volume and volatility in the initial announcement period of 1 percent and 2 percent. These small percentages raise the question of whether greater asymmetric timeliness is economically costly to investors.

Finding delayed resolution of investor disagreement and uncertainty at earnings announcements suggests that asymmetric timeliness also could delay price discovery. We test whether this is the case using the Heflin, Subramanyam, and Zhang (2003) absolute cumulative abnormal return metric. The findings are consistent with the prediction that asymmetric timeliness is significantly negatively related to price discovery. We find that a one-standard-deviation increase in our asymmetric timeliness measure is associated with a decrease in price discovery in the initial announcement period of 2 percent.

We also predict and find that stock returns in the later portion of the announcement period, i.e., days (3, 20), are positively related to our measure of asymmetric timeliness. We predict this because prior research finds that temporary increases in information uncertainty associated with information releases, such as earnings announcements, can result in temporary increases in discount rates, which, in turn, result in positive price adjustments after such information releases. In addition, because insiders know whether the firm is experiencing good or bad news and, thus, do not face the same uncertainty as other investors, we predict, but do not find clear evidence, that insiders take advantage of the positive price adjustment by purchasing the firm's shares.

We also test our predictions using an approach that does not rely on our measure of asymmetric timeliness. In particular, we estimate the Basu (1997) relation permitting the asymmetric timeliness coefficient to vary with each of our resolution measures. Findings from this alternative approach reveal the same inferences as those based on primary tests.

The remainder of this paper is organized as follows. Section II discusses the basis for our predictions and related research. Section III develops the research design, Section IV describes the sample, and Section V presents the results. Section VI concludes the study.

II. RELATED RESEARCH AND BASIS FOR PREDICTIONS

Related Research

Asymmetric Timeliness of Earnings

Basu (1997) and subsequent studies (Ball, Kothari, and Robin 2000; Qiang 2007; Beaver, Landsman, and Owens 2012) find evidence of asymmetric timeliness for U.S. firms. Because this can occur if earnings is conservative, in that good news is reflected in earnings after a positive change in economic value has occurred, Basu (1997) and most subsequent studies interpret asymmetric timeliness as evidence of conservatism. Regardless of the source, to the extent that a firm's earnings exhibits this asymmetric timeliness, earnings more closely reflects the change in the firm's economics when the firm has bad news. Basu (1997) adopts the view that stock return reflects the change in the firm's economics and, thus, a firm has good (bad) news when return is positive (negative). Hence, Basu (1997) measures asymmetric timeliness by a larger coefficient for negative return in the earnings-return regression.

Ball et al. (2000) and Ball, Robin, and Wu (2003), among others, find evidence of asymmetric timeliness for firms in several other countries, where the extent of asymmetric timeliness depends on a variety of institutional factors. Taken together, these studies show that asymmetric timeliness generally is higher for U.S. firms, which is interpreted as indirect evidence that conservatism is beneficial because the U.S. generally is viewed as having the most efficient capital market in the world. Other studies find that asymmetric timeliness has increased in the U.S. in the past few decades (Watts 2003a; Beaver et al. 2012), which the studies interpret as evidence that the demand for conservative accounting continues to increase.

Several studies identify benefits to equityholders from conservatism. Watts (2003a) explains that conservatism minimizes conflicts between debtholders and equityholders, thereby enabling more efficient contracting, which has benefits to equityholders in the form of lower debt costs. LaFond and Watts (2008) posit that conservatism reduces a manager's incentives and ability to manipulate accounting amounts, thereby reducing information asymmetry between firm insiders and outside equity investors. This results in higher equity values. LaFond and Watts (2008) find support for this supposition by providing evidence that information asymmetry is significantly negatively related to asymmetric timeliness after controlling for other demands for conservatism. D'Augusta, Bar-Yosef, and Prencipe (2016) find that asymmetric timeliness reduces abnormal trading volume in the three-day earnings announcement period, and interpret this finding as evidence that conservatism reduces investor disagreement at earnings announcements, thereby improving the firm's informational environment. However, other studies (Beaver 1968; Kim and Verrecchia 1991) interpret lower trading volume as evidence of lower information content and, thus, would adopt the opposite interpretation. Regardless, D'Augusta et al. (2016) do not examine whether asymmetric timeliness is associated with slower resolution of investor disagreement at earnings announcements, which is a focus of our study, nor do they examine investor uncertainty.

Kim, Li, Pan, and Zuo (2013) build on LaFond and Watts (2008) by predicting that conservatism reduces financing costs in seasoned equity offerings (SEOs) because conservatism mitigates the negative impact of information asymmetry. The logic supporting this prediction is that new investors would engage in less price protection when new shares are issued and, therefore, are willing to pay higher prices for the shares. Consistent with predictions, Kim et al. (2013) find that issuers with more conservatism—using a measure based in part on asymmetric timeliness—experience less negative equity returns at SEO announcements. Louis, Sun, and Urcan (2012) find that conservatism benefits equityholders by providing incentives for more efficient real investment decisions by managers. Using various proxies for conservatism, including asymmetric timeliness, Louis et al. (2012) find that the equity market values an additional dollar of cash holdings more for firms with more conservatism, which suggests that conservatism is associated with a more efficient use of cash. Francis, Hasan, and Wu (2013) find that firms with more conservatism, as reflected by greater asymmetric timeliness, had less significant equity value losses during the 2009 financial crisis. Balakrishnan, Watts, and Zuo (2016) find a similar result, and conclude that conservatism improved borrowing capacity, reduced underinvestment, constrained managerial opportunism, and enhanced firm value. García Lara, García Osma, and Penalva (2011) provide evidence that asymmetric timeliness is associated with lower implied cost of capital.

Fewer studies suggest that conservatism is associated with costs for debtholders and equityholders. Regarding debtholders, Gigler, Kanodia, Sapra, and Venugopalan (2009) show analytically that conservatism can decrease the efficiency of debt contracts if it results in unwarranted covenant violations.[3] Regarding equityholders, costs can arise from greater investor uncertainty concerning the implications for their investment decisions when a firm's earnings exhibits more conservatism. Mensah, Song, and Ho (2004) find evidence that analysts' earnings forecast errors and dispersion of analysts' forecasts are positively associated with the Penman and Zhang (2002) measure of conservatism. These findings suggest that conservatism makes it more difficult for analysts to forecast earnings. However, Mensah et al. (2004) do not address whether more conservatism makes it more difficult for investors to discern the implications for their investment decisions of earnings when they are announced.

The literature also provides evidence that conservatism varies across firms, by industry, and over time (Watts 2003b; Khan and Watts 2009), which suggests that firms face different costs and benefits associated with conservatism (LaFond and Roychowdhury 2008). We posit that one such cost is slower resolution of equity investor disagreement and uncertainty at earnings announcements associated with earnings that exhibit greater asymmetric timeliness. We contribute to the literature as it relates to equity markets by predicting and providing evidence that this is the case.

Complexity and the Resolution of Investor Disagreement and Uncertainty

Prior research uses trading volume and equity return volatility as measures of investor disagreement and uncertainty around the release of earnings news (Beaver 1968; Bamber 1986, 1987; Karpoff 1987; Holthausen and Verrecchia 1990; Kim and Verrecchia 1991; Landsman and Maydew 2002). The literature documents a sharp increase in trading volume and return volatility when firms announce earnings. As Beaver (1968) explains, whereas volume reflects changes in investors' portfolio positions, equity volatility reflects changes in investors' consensus beliefs regarding firm value. The increase in trading volume at earnings announcements reflects greater investor disagreement related to earnings news because greater disagreement increases the likelihood that investors will trade. The increase in stock return volatility reflects greater uncertainty because greater uncertainty increases the extent to which the earnings news changes investors' assessment of the potential stock price change.

When investors receive earnings news, they process the implications of such news for their investment decisions, namely, to buy, hold, or sell the firm's shares and at what price, and trade accordingly. However, these decisions can have different effects on volume and volatility. If investors have heterogeneous beliefs or preferences, then there could be trading volume after consensus regarding firm value is reached. If investors have homogeneous beliefs or preferences, then consensus regarding firm value could be reached on the first trade, which would result in a price change, but essentially no volume. It also is possible that an earnings announcement changes the expectations of individual investors, i.e., there would be trading volume, but no change in consensus beliefs regarding firm value, i.e., there would be no change in price and, thus, no volatility. Also, Holthausen and Verrecchia (1990) show that both volume and volatility are influenced by investor disagreement and uncertainty. We interpret trading volume (volatility) as primarily measuring the extent to which an announcement creates greater investor disagreement (uncertainty).

[3] Using a different model, Gao (2013) reaches the opposite conclusion, i.e., conservatism can increase the efficiency of debt contracts because renegotiations following covenant violations can increase earnings management, thereby making conservatism more attractive.

After investors fully process the earnings news, volume and volatility revert to normal levels. Prior research shows that investors' processing of information is not instantaneous because they have limited resources and processing abilities, and complexity can increase the cost of information processing, which can reduce the speed at which investor disagreement and uncertainty resolve (Simon 1978; Merton 1987; Bloomfield 2002; Hirshleifer and Teoh 2003). Thus, greater complexity increases information processing delays.

Basis for Predictions

We predict that earnings with greater asymmetric timeliness is associated with slower resolution of equity investor disagreement and uncertainty at earnings announcements. The logic underlying our prediction is as follows. When earnings is announced, each investor must assess the implications of earnings for firm value and whether the information in earnings alters the investor's desired holding of the firm's shares. Earnings comprising components with different implications for investors' investment decisions, i.e., whether to buy, hold, or sell the firm's shares and at what price, adds complexity to the assessment tasks. This is because investors must disaggregate earnings into these components in making their investment decisions. For example, assume that a firm reports earnings that comprises permanent and transitory components, where the former relates to ongoing operating activities and the latter relates to unrealized gains and losses. Each investor must assess the extent to which earnings comprises permanent and transitory components, and the implications of each component for the investor's investment decision.[4] The complexity arising from earnings components with different implications for investment decisions creates processing delays, which create the potential for disagreement among investors that takes time to resolve. Similarly, this complexity and attendant processing delays create uncertainty, which also takes time to resolve. This complexity and the processing delays exist even if the components are symmetrically timely with respect to recognizing good and bad news.[5]

A widely documented feature of current accounting practice is that earnings exhibits asymmetric timeliness. When earnings is asymmetrically timely, good news is recognized on a less timely basis than bad news. That is, when the firm has good (bad) news, transitory earnings components reflect less (more) of the change in the firm's economics. Thus, the implications of transitory earnings components for investment decisions depend on whether the firm has good or bad news. As a result, asymmetric timeliness creates more complexity than symmetric timeliness because investors must make an additional assessment when assessing the implications of earnings for their investment decisions, namely, whether the firm has good or bad news. This additional complexity potentially requires investors to spend more time to make their investment decisions. Hence, we predict that resolution of investor disagreement and uncertainty is slower when earnings is asymmetrically timely in recognizing good and bad news.

Greater asymmetric timeliness results in larger differences between good and bad news in the implications of earnings for investors' decisions. One reason for this is that the greater the proportion of the firm's earnings that is transitory, the greater the asymmetric timeliness, because more transitory earnings are recognized when the firm has bad news. Thus, earnings exhibiting greater asymmetric timeliness is more complex and, therefore, difficult for investors to process, which requires investors to take additional time when making their investment decisions. Hence, we predict that earnings exhibiting greater asymmetric timeliness is associated with slower resolution of equity investor disagreement and uncertainty.[6]

Our predictions do not imply that prices for firms with earnings exhibiting greater asymmetric timeliness are more or less informationally efficient than those for firms with earnings exhibiting less asymmetric timeliness. Our predictions also do not imply that earnings announcements are the primary source of information reflected in stock returns. Consistent with a vast literature on earnings announcements (e.g., Beaver 1968), we expect announced earnings to convey new information to investors, regardless of the extent of asymmetric timeliness. Our prediction is that it takes investors longer to process announced earnings when earnings exhibits greater asymmetric timeliness. For this reason, our study focuses on the speed with which investors process the information in earnings announcements, which is when new information comes from announced earnings and not from other sources.

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[4] These assessments are necessary because firms do not clearly distinguish transitory and permanent earnings components, cost of capital is unobservable (the inverse of which is, in principle, the multiple to apply to the permanent component), and investors can have different beliefs or preferences.

[5] In a different research setting, Cohen and Lou (2012) analogously predict and find that conglomerate firms, which have more valuation complexity than pure play firms, have slower resolution of stock prices following news announcements. This is because investors must disaggregate the news to understand the pricing implications of the news for each of the firm's segments.

[6] Asymmetric timeliness could arise from sources other than those associated with good and bad news. For example, neither all good nor all bad news is recognized in earnings on a timely basis, and good news relating to some assets can be recognized on a more timely basis than bad news relating to other assets. To the extent that sources of asymmetric timeliness other than those associated with good and bad news could delay the resolution of investor disagreement and uncertainty at earnings announcements, our tests, as described in Section III, will not detect them. Because, by design, our tests focus on the incremental relation between earnings and negative returns, i.e., when a firm has bad news, only sources of asymmetric timeliness correlated with more timely recognition of bad news will be detected by our tests.

III. RESEARCH DESIGN

Earnings Announcement Volume and Volatility

Testing our predictions relating to the speed of resolution of investor disagreement and uncertainty at earnings announcements requires measures of investor disagreement and uncertainty that reflect speed of resolution. As Section II explains, prior research commonly employs equity trading volume and stock return volatility as measures of investor disagreement and uncertainty. If an earnings announcement creates investor disagreement and uncertainty, then there will be trading volume and equity volatility until the disagreement and uncertainty resolve. To construct measures of volume and volatility that reflect speed of resolution, we use the proportions of trading volume and equity return volatility in the days immediately surrounding the announcement to those in the full announcement period. We predict that these proportions are larger for firms with less asymmetric timeliness.

Our first resolution measure, $EA\_VOLM_{i,t}$, reflects the proportion of earnings announcement trading volume that occurs in the initial announcement period. As shown in Equation (1), for firm *i,* we calculate it as the ratio of daily trading volume, *VOLM,* i.e., shares traded divided by shares outstanding, summed over the 4-day period surrounding the day $t = 0$ earnings announcement, (−1, 2), to daily trading volume summed over the interval beginning the day before the earnings announcement and ending 20 days after the announcement, (−1, 20).[7]

$$EA\_VOLM_{i,t} = \sum_{t=-1}^{2} VOLM_{i,t} \Big/ \sum_{t=-1}^{20} VOLM_{i,t} \tag{1}$$

We refer to the 4-day and 22-day periods as the initial and full earnings announcement periods. We measure the initial announcement period over the four days beginning at $t = -1$ because Bamber (1987) shows that the bulk of earnings announcement trading volume occurs during this period. We measure the full announcement period over the 22 days beginning at $t = -1$ because Beaver (1968) finds that earnings announcement volume extends up to four weeks.[8]

Our second resolution measure, $EA\_VOLA_{i,t}$, reflects the proportion of equity volatility that occurs in the initial announcement period. As shown in Equation (2), we calculate it as the ratio of daily equity volatility, *VOLA,* summed over the initial earnings announcement period, (−1, 2), to daily equity volatility summed over the full earnings announcement period, (−1, 20).

$$EA\_VOLA_{i,t} = \sum_{t=-1}^{2} VOLA_{i,t} \Big/ \sum_{t=-1}^{20} VOLA_{i,t} \tag{2}$$

Following prior literature (Beaver 1968; Landsman and Maydew 2002), we compute *VOLA* for day *t* as the square of residual stock return for that day. We calculate the daily residual return as the difference between realized return and expected return, based on the Fama and French (1993) three-factor model supplemented with the Carhart (1997) momentum factor, time-varying factor loadings based on 60 months of returns prior to year-end, risk-free interest rates, and risk premia.[9] Lower *EA_VOLM* and *EA_VOLA* indicate that investor disagreement and uncertainty resolve more slowly.[10]

We construct *EA_VOLM* and *EA_VOLA* to test our prediction that greater asymmetric timeliness is associated with slower resolution of investor disagreement and uncertainty at earnings announcements. This prediction implies that a lower proportion of the full earnings announcement period volume and volatility occurs in the initial announcement period for firms with greater asymmetric timeliness. Thus, the initial announcement period volume and volatility alone cannot be used to test our prediction. Other things equal, larger *EA_VOLM* (*EA_VOLA*) is consistent with both larger initial announcement period volume (volatility) and smaller remaining announcement period volume (volatility), i.e., that in days (3, 20). However, there is no mechanical reason for a larger or smaller initial announcement period volume (volatility) to imply a smaller or larger remaining announcement period volume (volatility).[11]

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[7] We exclude weekend days when constructing all day-referenced variables.

[8] Ending the full announcement period on day 20 presumes that investor disagreement and uncertainty resolve by then. We also construct our resolution measures ending the full announcement period on days 15 and 25. Untabulated findings from tests relating asymmetric timeliness and resolution of investor disagreement and uncertainty based on these alternative measures reveal the same inferences as those based on tabulated findings.

[9] To calculate *EA_VOLA* (*EA_VOLM*), we require a minimum of three days of non-missing returns (volume) in the initial announcement period, and 18 in the full announcement period.

[10] Because *EA_VOLM* (*EA_VOLA*) is the ratio of volume (volatility) for the initial announcement period to that of the full announcement period, the magnitude of pre-announcement volume (volatility) is irrelevant to the construction. That is, if we instead defined *VOLM* (*VOLA*) as the ratio of daily volume (volatility) to pre-announcement volume (volatility), pre-announcement volume (volatility) in the numerator and denominator of *EA_VOLM* (*EA_VOLA*) would cancel out.

[11] As discussed in Section II, D'Augusta et al. (2016) find that smaller initial announcement period volume is associated with greater asymmetric timeliness. However, because that study focuses on a different research question, it does not consider volume outside of the initial announcement period. Sections III and V develop tests and report findings regarding the extent to which volume and volatility in both the initial and remaining announcement periods are contributing factors to our findings based on *EA_VOLM* and *EA_VOLA*.

Measuring Asymmetric Timeliness of Earnings

Most asymmetric timeliness studies base their measure on Basu (1997). The Basu (1997) measure we employ is the incremental coefficient on negative annual stock return from a regression, as specified by Equation (3), of annual earnings on return that permits the coefficients to differ for positive and negative return.

$$X_{i,y} = \beta_0 + \beta_1 DR_{i,y} + \beta_2 R_{i,y} + \beta_3 DR_{i,y} \times R_{i,y} + v_{i,y}, \tag{3}$$

where X is earnings before extraordinary items and discontinued operations divided by end-of-year shares outstanding, deflated by beginning-of-year price. R is annual stock return beginning three months after the start of the year; DR is an indicator variable that equals 1 if R is negative, and 0 otherwise; and i and y refer to firm and year.[12] Basu (1997) finds that the incremental coefficient for negative return is significantly positive, and concludes that bad news is incorporated into earnings on a more timely basis. Thus, the larger the positive incremental coefficient on negative return, β_3, the relatively less timely is earnings when the firm experiences good news.[13] β_3 is referred to as the asymmetric timeliness coefficient.

Khan and Watts (2009) note that empirical research on conservatism using an asymmetric timeliness metric requires the metric to exhibit both cross-sectional and intertemporal variation. We accomplish this by estimating the asymmetric timeliness coefficient in Equation (3), *ATC,* using latent class analysis. In particular, we use a latent class model to group observations within each year into homogeneous classes with respect to Equation (3), i.e., the model allows for the possibility that different groups of firms have different asymmetric timeliness coefficients and identifies these groups (Larcker and Richardson 2004; Leisch 2004; Gruen and Leisch 2007, 2008). Although prior studies show that the asymmetric timeliness coefficient varies across firms and over time (Watts 2003b; Khan and Watts 2009; LaFond and Roychowdhury 2008), these studies pre-specify the firm characteristics that result in this variation, e.g., firm size. Using a latent class model does not require pre-specification of firm characteristics, but instead the model identifies homogeneous classes of observations with respect to the asymmetric timeliness coefficient.

The latent class model assigns observations to classes by maximizing the log-likelihood function of normally distributed residuals through iterative and simultaneous determination of the intercept and the coefficients on R, DR, and $DR \times R$ in Equation (3), the number of homogeneous classes, k, and the observations that belong to each of the k classes. We estimate this model using the expectation maximization algorithm (Dempster, Laird, and Rubin 1977; Tanner 1996), which iterates until the intercepts and coefficients converge for the k classes. k is the number of classes that minimizes the Bayesian Information Criterion (Nylund, Asparouhov, and Muthén 2007).[14] We then estimate Equation (3) for each of the k classes within each year. For each firm-year observation, *ATC* is the $DR \times R$ coefficient from Equation (3) for the latent class to which it belongs.

Asymmetric Timeliness of Earnings and Earnings Announcement Volume and Volatility

To test whether asymmetric timeliness is associated with slower resolution of investor disagreement, as reflected in our trading volume measure, we estimate Equation (4).

$$EA\_VOLM_{i,y} = \alpha_0 + \alpha_1 ATC_{i,y} + Controls_{i,y} + \varepsilon_{i,y} \tag{4}$$

To test whether asymmetric timeliness is associated with slower resolution of investor uncertainty, as reflected in our equity volatility measure, we estimate Equation (5).

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[12] Measuring R as we do generally means that the annual return period includes the earnings announcement. One way to ensure that the annual return period includes the announcement is to end the annual return period 20 days after the firm's earnings announcement. We do not use this approach to avoid overlapping annual return periods. Another way is to eliminate from the sample those observations for which the earnings announcement period ends after the annual return period. Untabulated findings reveal that eliminating the 7 percent of such observations from our tests does not alter our inferences based on the findings in Table 3. We assign a firm-year observation to year y based on the calendar year of the firm's fiscal year-end.

[13] Basu (1997) also measures asymmetric timeliness based on the ratio of the sum of the positive and negative return coefficients to the positive return coefficient, i.e., $(\beta_2 + \beta_3)/\beta_2$. This measure also is employed by Givoly and Hayn (2000), Ryan and Zarowin (2003), and Beaver et al. (2012), among others, although the incremental coefficient typically is the primary focus. We do not use the ratio measure because most of our sample years are post-1996, after which Ryan and Zarowin (2003) find that the positive return coefficient is negative and insignificantly different from zero. Givoly and Hayn (2000) and Ryan and Zarowin (2003) offer as an explanation the greater presence of younger, less profitable, and high-growth firms in post-Basu (1997) sample years.

[14] We implement the latent class analysis using the FlexMix package for R maintained by Bettina Gruen, and available at: https://CRAN.R-project.org/package=flexmix (Leisch 2004; Gruen and Leisch 2007, 2008). Implementation of the latent class analysis requires setting a maximum for k, which we set to ten. In one year, 2000, the model identifies ten groups. We also set the maximum to 20 and find that the maximum number of classes the model identifies is ten, which suggests that setting the maximum to ten is not binding.

$$EA\_VOLA_{i,y} = \alpha_0 + \alpha_1 ATC_{i,y} + Controls_{i,y} + \varepsilon_{i,y} \quad (5)$$

We predict that the *ATC* coefficients, α_1, are negative for both equations.[15]

Controls includes the following variables. *Size,* firm size, is the natural logarithm of equity market value; *BM* is the equity book-to-market ratio; and *Lev,* financial leverage, is the ratio of current plus long-term debt to total assets. *Beta* is the coefficient on the market return less the risk-free rate from the model we use to calculate expected return when constructing *EA_VOLA*. We include these variables, all of which are measured as of fiscal year-end, because Khan and Watts (2009) find that they are associated with the asymmetric timeliness coefficient and because they are fundamental risk characteristics identified in prior research (Bernard and Thomas 1990; Fama and French 1993; Jiang, Lee, and Zhang 2005; Livnat and Mendenhall 2006; Zhang 2006b).

We include the next set of control variables because prior research shows that they are correlated with equity volume and volatility. *NUMEST* is analyst following, measured as the natural logarithm of 1 plus the number of analyst earnings forecasts outstanding prior to the earnings announcement. *INST* is the percent of shares held by institutional investors as of fiscal year-end or as of the most recent month that is, at most, four months prior to fiscal year-end. We set *INST* to 0 for observations with no institutional investor information. We include *NUMEST* and *INST* as controls for the firm's information environment at the earnings announcement (Gleason and Lee 2003). *MOM* is pre-announcement period price momentum, which equals the firm's stock return for the first ten months of the current year. We include *MOM* because prior research establishes a positive relation between past stock market returns and investor attention (Aboody, Lehavy, and Trueman 2010).

EA_RET, the earnings announcement return, is the Fama and French (1993) three-factor and momentum model factor-adjusted returns in the initial announcement period. We include *EA_RET* as a control for the signed magnitude of news at the earnings announcement. *FE* is the mean analyst earnings forecast outstanding prior to the earnings announcement minus actual earnings; and ΔNI is the annual change in net income, *X*. We include *FE* and ΔNI because prior research establishes that these variables are associated with earnings announcement returns (Brown, Hagerman, Griffin, and Zmijewski 1987).

NEG is an indicator variable that equals 1 if the current year's earnings is negative, and 0 otherwise. *FLOSS* is the frequency of past losses, i.e., the percentage of the 16 quarters prior to the current year for which the firm's earnings is negative. We set *FLOSS* to missing if a firm has fewer than four quarters of earnings in those 16 quarters. We include *NEG* and *FLOSS* because prior research finds that the market reaction at earnings announcements differs for firms with losses (Landsman, Maydew, and Thornock 2012; Beaver, McNichols, and Wang 2018).

TURN_Pre is average daily share turnover during the pre-announcement period, which we define as days (−40, −10) relative to the earnings announcement. We begin the pre-announcement period at day −40 to avoid contaminating effects of the prior quarter's earnings announcement, and end at day −10 to avoid contaminating effects of anticipation of the current earnings announcement. *TURN_Std* is the standard deviation of monthly share turnover, i.e., monthly trading volume divided by end-of-month shares outstanding, for the prior three years. We include *TURN_Pre* and *TURN_Std* as controls for pre-announcement trading volume because prior research establishes a positive relation between trading volume and investor attention (Barber and Odean 2008; Hou, Xiong, and Peng 2009). *ASQRET* is average squared daily abnormal return, relative to the Fama and French (1993) three-factor and momentum model, during the pre-announcement period. We include *ASQRET* as a control for pre-announcement return volatility. For expositional purposes, we multiply *TURN_Pre* and *ASQRET* by 100 to align their magnitudes with that of *ATC*.[16]

SPI, special items, is the tercile rank of the ratio of the absolute value of special items to beginning-of-year equity market value. We use the rank of special items because the distribution of the continuous measure is highly skewed.[17] We include *SPI* because it is possible that the asymmetric timeliness coefficient is associated with special items, which typically are large negative earnings components. *RD* is an indicator that equals 1 if the firm reported research and development expense in the prior year, and 0 otherwise. We include *RD* to allow for the possibility that more research and development expense is associated with greater investor disagreement and uncertainty.

Bundled_Bad, bad news bundled with the earnings announcement, is an indicator variable for whether the firm issued a bad news annual earnings forecast during the initial announcement period. We set *Bundled_Bad* to 0 for observations with no forecast information.[18] We include *Bundled_Bad* because Rogers and Van Buskirk (2013) find that firms bundle earnings

[15] For ease of exposition, we use the same notation for coefficients and error terms in various equations. In all likelihood, they differ. Throughout, we use a 5 percent significance level under a one-tailed alternative when we have a signed prediction, and under a two-tailed alternative otherwise.

[16] To construct *ASQRET,* we use Fama-French and momentum factor loadings as of the end of the prior fiscal year to avoid look-ahead bias. To compute *TURN_Pre, TURN_Std,* and *ASQRET,* we require a minimum of 25, 18, and 25 non-missing observations.

[17] We also estimated Equations (4) and (5) using the continuous measure of special items rather than the tercile rank measure. Untabulated findings reveal the same inferences as those based on the findings in Table 3.

[18] Specifically, the indicator variable equals 1 for firms with bundled earnings guidance—either the point forecast or the mean of the range forecast—that is less than the most recent consensus analyst forecast, and 0 otherwise, i.e., firms for which bundled earnings guidance is greater than the most recent consensus analyst forecast and firms with no bundled guidance. We also estimated Equations (4) and (5) defining the indicator variable to equal 1 if the firm provided any bundled management guidance. Untabulated findings reveal the same inferences as those based on the Table 3 findings.

forecasts with earnings announcements, and Rogers, Skinner, and Van Buskirk (2009) find that bad news earnings forecasts create greater uncertainty. *Revisions,* analyst forecast revision activity, is the natural logarithm of 1 plus the number of analyst earnings forecast revisions or confirmations during the remaining announcement period. We include *Revisions* because prior research shows that analysts' forecast revisions are informative to the market, thereby generating increases in equity volume and volatility (Francis, Schipper, and Vincent 2002; Irvine 2004; Frankel, Kothari, and Weber 2006). *EA_Arts,* a proxy for other firm-related information, is the natural logarithm of 1 plus the number of articles listed on the Dow Jones Newswire about the firm during the remaining announcement period. We set *EA_Arts* to 0 for observations with no article information. We include *EA_Arts* because it is possible that a bad news earnings announcement could create incentives for firms to release additional information, perhaps to offset the bad news, that is reflected in additional news coverage.[19]

DISP is the standard deviation of analyst forecasts of the current year's earnings, based on analyst forecasts outstanding prior to the earnings announcement and scaled by beginning-of-year price.[20] *AbsFE* is the absolute value of *FE*. We include *DISP* and *AbsFE* as controls for the magnitude of analyst forecast error and forecast dispersion (Mensah et al. 2004), which are indications of uncertainty prior to the earnings announcement (Barron, Kim, Lim, and Stevens 1998; Barron and Stuerke 1998; Zhang 2006a).

Equations (4) and (5) also include fixed effects for industry and earnings announcement month-year, where we define industry as in Barth, Beaver, and Landsman (1998).[21] We base t-statistics for Equations (4) and (5) and all regression equations that follow on standard errors clustered by firm and earnings announcement month-year, except for Equation (9), in which we base significance on the Fama and MacBeth (1973) approach.

Contribution of the Initial and Remaining Announcement Periods

Estimation of Equations (4) and (5) permits us to assess whether resolution of investor disagreement and uncertainty is slower for firms with greater asymmetric timeliness. However, estimation of these equations does not address the extent to which investor disagreement and uncertainty during the initial and remaining announcement periods are contributing factors. For example, it is possible to find that slower resolution of investor disagreement and uncertainty for firms with greater asymmetric timeliness is attributable to the market reaction in the initial announcement period, and there is no difference in the market reaction in the remaining announcement period.[22]

To provide evidence on the incremental contributions of the initial and remaining announcement periods in explaining the relation between *ATC* and our resolution measures in Equations (4) and (5), we estimate following equations:

$$ATC_{i,y} = \alpha_0 + \alpha_1 ABVOLM\_I_{i,y} + \alpha_2 ABVOLM\_R_{i,y} + Controls_{i,y} + \varepsilon_{i,y} \tag{6}$$

$$ATC_{i,y} = \alpha_0 + \alpha_1 ABVOLA\_I_{i,y} + \alpha_2 ABVOLA\_R_{i,y} + Controls_{i,y} + \varepsilon_{i,y} \tag{7}$$

ABVOLM_I and *ABVOLA_I* are abnormal volume and volatility during the initial announcement period, and *ABVOLM_R* and *ABVOLA_R* are abnormal volume and volatility during the remaining announcement period. Abnormal volume (volatility) is the ratio of the average daily volume (volatility) in the initial or remaining announcement period to the average daily volume (volatility) in the pre-announcement period, i.e., *TURN_Pre* (*ASQRET*).[23] Equation (6) (Equation (7)) excludes *TURN_Pre* (*ASQRET*) because it is the denominator of abnormal volume (volatility). For expositional purposes, we divide *ABVOLM_I, ABVOLM_R, ABVOLA_I,* and *ABVOLA_R* by 100 to align their magnitudes with that of *ATC*. Equations (6) and (7) include the same fixed effects as Equations (4) and (5), but *Controls* excludes *NEG* and ΔNI.[24]

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[19] The data required to construct *EA_Arts* are not available before January 2000. To assess the sensitivity of our inferences to setting *EA_Arts* to 0 in these years, we also estimated versions of Equations (4) and (5) excluding *EA_Arts* and using observations associated with fiscal years 1999 onward. Untabulated statistics reveal the same inferences as those based on the Table 3 findings.

[20] To construct *DISP,* we require at least three forecasts. Both *DISP* and *FE* are scaled by beginning-of-year stock price and, to construct them, we exclude forecasts made more than 120 calendar days before the earnings announcement. For expositional purposes, we multiply *DISP* by 100 to align its magnitude with that of *ATC*.

[21] Barth et al. (1998) identify 13 industries. Other studies that use the Barth et al. (1998) industry classification include, e.g., Brown (2011), Thevenot (2012), and Ball and Easton (2013). Untabulated findings using the Fama and French (1997) 12-industry classification reveal inferences identical to those based on the tabulated findings relating to Equations (4) and (5).

[22] We thank a consulting reviewer for pointing out this possibility and for offering suggestions that led to our analysis in Equations (6) and (7).

[23] We measure abnormal volume and volatility scaling by pre-announcement volume and volatility, rather than post-announcement amounts, because Beaver (1968) shows that volume and volatility remain elevated for several weeks subsequent to the announcement.

[24] Equations (6) and (7) exclude *NEG* and ΔNI because *ATC,* the dependent variable in these equations, is an estimate of β_3 in Equation (3), which specifies net income, *X*, as a function of β_3. Including *NEG* and ΔNI in Equations (6) and (7) effectively specifies β_3 as a function of net income, which would mean that Equation (3) is part of a simultaneously determined system. However, neither Basu (1997) nor subsequent studies based on it posit the appropriateness of such a system of equations.

Equations (6) and (7) reverse the relation between *ATC* and volume and volatility in Equations (4) and (5) to permit us to determine the extent to which the abnormal volume and volatility in the initial and remaining announcement periods are associated incrementally with *ATC*. We include initial and remaining abnormal volume or volatility in the same equation as a control for the possibility that larger initial abnormal volume or volatility leads to smaller remaining abnormal volume or volatility, or *vice versa*.

If greater asymmetric timeliness is associated with slower resolution of investor disagreement and uncertainty at earnings announcements, then we predict that firms with higher (lower) asymmetric timeliness have lower (higher) abnormal volume and volatility during the initial announcement period, and higher (lower) abnormal volume and volatility during the remaining announcement period. Thus, we predict $\alpha_1 < 0$ and $\alpha_2 > 0$ in Equations (6) and (7).

IV. SAMPLE AND DESCRIPTIVE STATISTICS

We begin by obtaining all firm-year observations from Compustat and CRSP with fiscal year-ends from 1994 to 2011 that have data sufficient to estimate Equation (3), i.e., non-missing earnings and return. We require firms to have SIC information and, following Callen, Segal, and Hope (2010), we eliminate financial firms (SIC = 6000 through 6999). Next, we eliminate observations with stock price less than $5 at year-end and with earnings and return in the largest 99 percent and smallest 1 percent of the distribution for each year (Basu 1997; Khan and Watts 2009). This results in an initial sample of 57,355 observations. We use this initial sample as the basis for the latent class analysis to estimate *ATC*.[25]

We obtain information relating to analysts' forecasts and management guidance from the I/B/E/S summary file, and firm-related information during the earnings announcement from RavenPack. The final sample of 24,310 annual earnings announcements we use as the basis for our tests comprises all firm-year observations with data necessary to estimate Equations (4) and (5), and for which equity book value is positive (Khan and Watts 2009). To mitigate the effects of outliers on our inferences, we winsorize all continuous variables at the 1st and 99th percentiles of all sample observations, with the exception of earnings and return.

Table 1 presents descriptive statistics for the variables used in estimating Equations (4) through (10). Table 1 reveals that means (medians) for *EA_VOLM* and *EA_VOLA* are 0.25 (0.24) and 0.35 (0.30), which indicates that for both measures, the market reaction during the initial announcement period is a substantial portion of the volume and volatility during the full announcement period. If volume and volatility were constant over the full announcement period, then mean and median *EA_VOLM* and *EA_VOLA* would be 18 percent, i.e., 4/22, during the initial announcement period. Table 1 also reveals that mean (median) *ATC* is 0.11 (0.09), which is similar to the asymmetric timeliness coefficient in Beaver et al. (2012), 0.15, that is based on a sample period that overlaps with ours. Table 1 also reveals that the mean *ABVOLM_I* and *ABVOLM_R* (*ABVOLA_I* and *ABVOLA_R*) are 1.74 and 1.14 (3.61 and 1.08). These statistics indicate that, on average, volume and volatility exceed pre-announcement volatility in both the initial and remaining announcement periods.

Table 2 presents Pearson correlations between the key experimental variables in Equations (4) through (7), i.e., *ATC, EA_VOLM, EA_VOLA, ABVOLM_I, ABVOLM_R, ABVOLA_I, ABVOLA_R,* and between these variables and the other variables in Equations (3) through (7). Table 2 reveals that *ATC* is significantly negatively correlated with *EA_VOLM* and *EA_VOLA;* the correlations between *ATC* and *EA_VOLM* and *EA_VOLA* are −0.03 and −0.06. In addition, many of the control variables are significantly correlated with *EA_VOLM, EA_VOLA,* and *ATC*. Table 2 also reveals that the correlations between *ABVOLM_I* and *ABVOLM_R* (*ABVOLA_I* and *ABVOLA_R*) and *ATC* are −0.03 and 0.00 (−0.05 and 0.02). However, the two volume and volatility measures are highly correlated, i.e., the *ABVOLM_I* and *ABVOLM_R* correlation is 0.45 and the *ABVOLA_I* and *ABVOLA_R* correlation is 0.23, which suggests the need to infer the relations between the initial and remaining measures and *ATC* in a multiple regression framework.

V. RESULTS

Asymmetric Timeliness and Earnings Announcement Volume and Volatility

Table 3 presents regression summary statistics for Equations (4) and (5). The key finding is that, consistent with predictions, the *ATC* coefficient is significantly negative for both equations. In particular, the *ATC* coefficients (t-statistics) are −0.02 and −0.06 (−2.48 and −3.75) in the *EA_VOLM* and *EA_VOLA* equations. These findings are consistent with greater

[25] Untabulated statistics reveal that the latent class model identifies a mean of 7.06 classes per year, with a range from three in 1996 to ten in 2000. However, for six classes comprising 524 observations, or about 1 percent of the initial sample, there is insufficient variation in *DR* to estimate a coefficient for *DR* and $DR \times R$ and, thus, *ATC*. Therefore, we exclude these observations from our sample.

TABLE 1

Descriptive Statistics

Variable	Mean	Median	Std. Dev.
X	0.04	0.05	0.07
R	0.13	0.08	0.48
DR	0.41	0.00	0.49
ATC	0.11	0.09	0.11
EA_VOLM	0.25	0.24	0.09
EA_VOLA	0.35	0.30	0.23
ABVOLM_I	1.74	1.47	1.10
ABVOLM_R	1.14	1.03	0.53
ABVOLA_I	3.61	1.56	5.82
ABVOLA_R	1.08	0.81	0.93
Size	14.16	14.04	1.60
BM	0.79	0.46	1.75
Lev	0.22	0.22	0.17
NUMEST	2.25	2.20	0.58
MOM	0.09	0.06	0.39
EA_RET	0.00	0.00	0.08
NEG	0.15	0.00	0.36
TURN_Pre	0.81	0.59	0.72
SPI	0.95	1.00	0.85
Bundled_Bad	0.13	0.00	0.34
Revisions	0.90	0.69	0.72
EA_Arts	2.01	2.20	1.89
ASQRET	0.07	0.04	0.10
AbsFE	0.00	0.00	0.01
DISP	0.27	0.10	0.55
FE	0.00	0.00	0.01
RD	0.48	0.00	0.50
FLOSS	0.15	0.06	0.23
TURN_Std	0.81	0.57	0.75
INST	0.55	0.64	0.35
Beta	1.07	1.02	0.59
ΔNI	0.00	0.00	0.08

Table 1 presents descriptive statistics for the variables used in our tests. All continuous variables are winsorized at the 1st and 99th percentiles except for *X* and *R*, which are trimmed at the 1st and 99th percentiles in the *ATC* sample (Basu 1997). The sample comprises 24,310 annual earnings announcements relating to fiscal years ending 1994 to 2011.

Variable Definitions:
X = earnings before extraordinary items and discontinued operations divided by end-of-year shares outstanding, deflated by beginning-of-year price;
R = annual stock return beginning three months after the start of the year;
DR = an indicator variable that equals 1 if *R* is negative, and 0 otherwise;
ATC = the asymmetric timeliness coefficient;
EA_VOLM (*EA_VOLA*) = the ratio of the sum of daily trading volume (return volatility) in the initial announcement period, i.e., days (−1, 2), to the sum of daily trading volume (return volatility) in the full announcement period, i.e., days (−1, 20);
ABVOLM_I and *ABVOLA_I* = abnormal volume and volatility during the initial announcement period;
ABVOLM_R and *ABVOLA_R* = abnormal volume and volatility during the remaining announcement period, i.e., days (3, 20). Abnormal volume (volatility) is the ratio of the average daily volume (volatility) in the initial or remaining announcement period to the average daily volume (volatility) in the pre-announcement period, i.e., days (–40, –10);
Size = the natural logarithm of market value of equity;
BM = the ratio of book value of equity to market value of equity;
Lev = the ratio of debt to total assets, all measured at fiscal year-end;
NUMEST = the natural logarithm of 1 plus the number of analyst earnings forecasts prior to the earnings announcement;
MOM = the firm's stock return for the first ten months of the year;
EA_RET = the signed excess return during the initial announcement period;
NEG = an indicator variable that equals 1 if earnings is negative, and 0 otherwise;
TURN_Pre = the average daily share turnover during the pre-announcement period;
SPI = the tercile rank of the ratio of the absolute value of special items to beginning-of-year equity market value;

(continued on next page)

TABLE 1 (continued)

Bundled_Bad = an indicator variable for whether the firm issued a bad news management forecast during the initial announcement period;
Revisions = the natural logarithm of 1 plus the number of analyst earnings forecast revisions or confirmations made during the remaining announcement period;
EA_Arts = the natural logarithm of 1 plus the number of articles listed on the Dow Jones Newswire about the firm during remaining announcement period;
ASQRET = average squared daily abnormal return during the pre-announcement period;
AbsFE = the absolute value of the difference between the mean analyst forecast of the current year's earnings and actual earnings scaled by beginning-of-year price;
DISP = the standard deviation of analyst forecasts of the current year's earnings scaled by beginning-of-year price;
FE = the difference between the mean analyst forecast of the current year's earnings and actual earnings scaled by beginning-of-year price;
RD = an indicator that equals 1 if the firm reported research and development expense in the prior year, and 0 otherwise;
FLOSS = the frequency of loss, i.e., the percentage of the 16 quarters prior to the current year for which the firm's earnings is negative;
TURN_Std = the standard deviation of monthly share turnover for the prior three years;
INST = the percent of shares held by institutional investors as of fiscal year-end or as of the most recent month that is, at most, four months prior to fiscal year-end;
Beta = the coefficient on the market return less the risk-free rate from the model we use to calculate expected return when constructing *EA_VOLA;* and
ΔNI = the annual change in net income, *X*.

TABLE 2

Correlation Matrix

	ATC	*EA_VOLM*	*EA_VOLA*	*ABVOLM_I*	*ABVOLM_R*	*ABVOLA_I*	*ABVOLA_R*
EA_VOLM	**−0.03**						
EA_VOLA	**−0.06**	**0.55**					
ABVOLM_I	**−0.03**	**0.68**	**0.47**				
ABVOLM_R	0.00	**−0.24**	−0.01	**0.45**			
ABVOLA_I	**−0.05**	**0.40**	**0.66**	**0.55**	**0.21**		
ABVOLA_R	0.02	**−0.16**	**−0.23**	**0.13**	**0.41**	**0.23**	
X	**−0.17**	**−0.04**	−0.01	0.01	**0.07**	0.00	0.00
R	**0.04**	−0.01	0.00	**0.06**	**0.08**	0.01	**0.02**
DR	**−0.04**	**0.02**	0.00	**−0.04**	**−0.07**	−0.01	**−0.02**
Size	**−0.14**	−0.01	**0.07**	**−0.06**	**−0.07**	**0.03**	**−0.04**
BM	**0.05**	**−0.08**	**−0.08**	**−0.07**	0.00	**−0.06**	0.00
Lev	**0.05**	**−0.14**	**−0.12**	**−0.11**	0.01	**−0.08**	**0.03**
NUMEST	**−0.06**	**0.02**	**0.03**	**−0.04**	**−0.07**	−0.01	**−0.05**
MOM	**−0.04**	**0.03**	**0.02**	**0.05**	**0.03**	0.01	−0.01
EA_RET	**−0.02**	0.00	**0.06**	**−0.05**	**−0.04**	0.00	**−0.07**
NEG	**0.48**	−0.01	**−0.05**	**−0.03**	**−0.02**	**−0.03**	**0.03**
TURN_Pre	**0.05**	**0.18**	**0.10**	**−0.02**	**−0.20**	0.01	**−0.11**
SPI	**0.11**	**0.02**	**0.05**	0.00	−0.02	**0.04**	0.01
Bundled_Bad	**−0.10**	**0.09**	**0.12**	**0.07**	0.00	**0.09**	−0.01
Revisions	0.00	**−0.10**	**−0.08**	**−0.05**	**0.04**	**−0.06**	**0.05**
EA_Arts	**−0.07**	**0.09**	**0.16**	**0.06**	0.00	**0.14**	0.02
ASQRET	**0.13**	0.01	**−0.07**	**−0.10**	**−0.13**	**−0.16**	**−0.20**
AbsFE	**0.21**	−0.01	**−0.04**	0.00	**0.02**	−0.01	**0.03**
DISP	**0.21**	**−0.05**	**−0.08**	**−0.04**	0.01	**−0.05**	**0.02**
FE	**0.11**	**−0.03**	**−0.04**	**−0.03**	−0.01	**−0.02**	**0.02**
RD	**0.03**	**0.12**	**0.11**	**0.08**	**−0.02**	**0.07**	**−0.03**
FLOSS	**0.24**	**0.02**	**−0.03**	0.00	−0.01	**−0.02**	**0.03**
TURN_Std	**0.11**	**0.18**	**0.09**	**0.11**	**−0.05**	**0.05**	**−0.03**
INST	**−0.05**	**0.15**	**0.18**	**0.12**	−0.01	**0.14**	−0.01
Beta	**0.09**	**0.07**	**0.03**	**0.04**	−0.01	0.01	**−0.02**
ΔNI	**−0.20**	0.00	**0.02**	**0.02**	**0.02**	0.01	−0.01

Table 2 presents selected sample Pearson correlations. Correlations that are significantly different from zero at the 5 percent level under a two-tailed alternative are in bold. The sample comprises 24,310 annual earnings announcements relating to fiscal years ending 1994 to 2011.
Variables are defined in Table 1.

TABLE 3

***EA_VOLM* and *EA_VOLA* and Asymmetric Timeliness**

$$EA\_VOLM_{i,y} = \alpha_0 + \alpha_1 ATC_{i,y} + Controls_{i,y} + \varepsilon_{i,y}$$

$$EA\_VOLA_{i,y} = \alpha_0 + \alpha_1 ATC_{i,y} + Controls_{i,y} + \varepsilon_{i,y}$$

	EA_VOLM		*EA_VOLA*	
Variable	**Coefficient**	**t-stat**	**Coefficient**	**t-stat**
ATC	−0.02**	−2.48	−0.06**	−3.75
Size	−0.00**	−4.70	0.00	1.20
BM	−0.00**	−6.83	−0.01**	−5.93
Lev	−0.01**	−2.86	−0.04**	−3.53
NUMEST	0.02**	7.96	0.02**	3.65
MOM	0.00	1.80	−0.00	−0.51
EA_RET	−0.01	−0.45	0.18**	6.86
NEG	−0.01**	−3.15	−0.02**	−3.05
TURN_Pre	0.01**	5.97	0.00	1.13
SPI	0.00	0.40	0.01**	3.09
Bundled_Bad	0.01**	3.96	0.01*	2.34
Revisions	−0.01**	−6.48	−0.02**	−4.88
EA_Arts	−0.00**	−5.77	−0.01**	−4.52
ASQRET	−0.00	−0.33	−0.07**	−2.95
AbsFE	0.34**	4.09	0.59**	2.79
DISP	−0.00*	−2.37	−0.01*	−2.06
FE	−0.16	−1.78	−0.09	−0.49
RD	0.01*	2.53	0.02**	3.23
FLOSS	−0.01*	−2.44	−0.04**	−4.05
TURN_Std	0.01**	6.99	0.01**	3.86
INST	0.01**	5.32	0.05**	6.65
Beta	0.00	0.71	0.00	0.46
ΔNI	−0.02*	−2.22	0.00	0.06
Observations	24,310		24,310	
Adjusted R^2	0.14		0.14	

**, * Indicate significance at the 1 percent and 5 percent levels under a one-tailed alternative when we have a signed prediction, and under a two-tailed alternative otherwise.

Table 3 presents regression summary statistics for Equations (4) and (5). The regressions include industry and earnings announcement month-year fixed effects. The table presents t-statistics based on standard errors clustered by firm and earnings announcement month-year. All continuous variables are winsorized at the 1st and 99th percentiles. The sample comprises 24,310 annual earnings announcements relating to fiscal years ending 1994 to 2011. All variables are defined in Table 1.

asymmetric timeliness being associated with slower resolution of investor disagreement, as reflected in trading volume, and longer for average investor beliefs to change fully, as reflected in equity volatility.[26]

In terms of economic significance, the findings in Table 3 indicate that holding everything else constant, increasing *ATC* by one standard deviation decreases *EA_VOLM* by 0.0022 (= –0.02 × 0.11) from its mean of 0.25 to 0.2478, or 1 percent. Similarly, holding everything else constant, increasing *ATC* by one standard deviation decreases *EA_VOLA* by 0.0066 (= –0.06 × 0.11) from its mean of 0.35 to 0.3434, or 2 percent.

[26] Khan and Watts (2009) develop a firm-year measure of conservatism, *CSCORE,* by expressing the asymmetric timeliness coefficient as a linear function of firm size, the equity market-to-book ratio, and leverage, which are control variables in Equations (4) and (5). Untabulated findings reveal that although a *CSCORE* measure we construct following Khan and Watts (2009) has a significantly negative correlation with *EA_VOLM* and *EA_VOLA,* its coefficients in Equations (4) and (5) are not significantly different from zero (t-statistics = −1.04 and −1.34). These results are not surprising in light of the fact that *CSCORE* is constructed from three of our control variables.

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TABLE 4

Contribution of the Initial and Remaining Announcement Periods

$$ATC_{i,y} = \alpha_0 + \alpha_1 ABVOLM\_I_{i,y} + \alpha_2 ABVOLM\_R_{i,y} + Controls_{i,y} + \varepsilon_{i,y}$$

$$ATC_{i,y} = \alpha_0 + \alpha_1 ABVOLA\_I_{i,y} + \alpha_2 ABVOLA\_R_{i,y} + Controls_{i,y} + \varepsilon_{i,y}$$

Variable	Coefficient	t-stat	Coefficient	t-stat
ABVOLM_I	−0.23**	−3.21		
ABVOLM_R	0.32*	2.17		
ABVOLA_I			−0.06**	−6.04
ABVOLA_R			0.18**	2.35
Size	−0.00**	−4.09	−0.01**	−4.47
BM	0.00	1.48	0.00	1.18
Lev	0.03**	4.90	0.02**	4.77
NUMEST	0.01*	2.32	0.01*	2.51
MOM	−0.00	−1.02	−0.00	−0.90
EA_RET	−0.01	−1.17	−0.01	−0.86
TURN_Pre			−0.00	−1.44
SPI	0.01**	6.94	0.01**	6.99
Bundled_Bad	−0.02**	−4.81	−0.02**	−4.78
Revisions	0.00	0.25	0.00	0.40
EA_Arts	−0.00	−1.56	−0.00	−1.34
ASQRET	0.05**	3.28		
AbsFE	0.77**	5.55	0.78**	5.65
DISP	0.01**	4.12	0.01**	4.19
FE	0.39**	4.10	0.40**	4.18
RD	0.00	1.89	0.00*	2.00
FLOSS	0.08**	11.64	0.08**	12.00
TURN_Std	0.00	1.05	0.00*	2.50
INST	0.00	1.61	0.00	1.62
Beta	0.00	1.44	0.00	1.94
Observations	24,310		24,310	
Adjusted R^2	0.18		0.18	

**, * Indicate significance at the 1 percent and 5 percent levels under a one-tailed alternative when we have a signed prediction, and under a two-tailed alternative otherwise.

Table 4 presents regression summary statistics for Equations (6) and (7). The regressions include industry and earnings announcement month-year fixed effects. The table presents t-statistics based on standard errors clustered by firm and earnings announcement month-year. All continuous variables are winsorized at the 1st and 99th percentiles. The sample comprises 24,310 annual earnings announcements relating to fiscal years ending 1994 to 2011. All variables are defined in Table 1.

Contribution of the Initial and Remaining Announcement Periods

Table 4 presents regression summary statistics for Equations (6) and (7). Consistent with predictions, the initial announcement period abnormal volume and volatility coefficients are significantly negative, and the remaining announcement period abnormal volume and volatility coefficients are significantly positive. In particular, the *ABVOLM_I, ABVOLM_R, ABVOLA_I,* and *ABVOLA_R* coefficients are −0.23, 0.32, −0.06, and 0.18 (t-statistics = −3.21, 2.17, −6.04, and 2.35). These findings indicate that investor disagreement and uncertainty during both the initial and remaining announcement periods are contributing factors to the negative correlation between our resolution measures and *ATC* in Table 3.

Figure 1, Panel A (Panel B) graphically displays daily abnormal volume (volatility) during the initial and remaining announcement periods, i.e., days (−1, 2) and days (3, 20), controlling for abnormal volume (volatility) in the remaining and initial announcement periods. Panel A (Panel B) depicts means of daily residuals from regressions of daily abnormal volume (volatility) on mean daily abnormal volume (volatility) during the initial and remaining announcement periods for firm-years in the highest and lowest ATC quintiles. To illustrate the incremental relations between ATC and abnormal volume and volatility

FIGURE 1
Daily Abnormal Volume and Volatility During the Initial (Remaining) Announcement Period, Controlling for Abnormal Volume and Volatility in the Remaining (Initial) Announcement Period for Top and Bottom *ATC* Quintiles

Panel A: Daily Volume

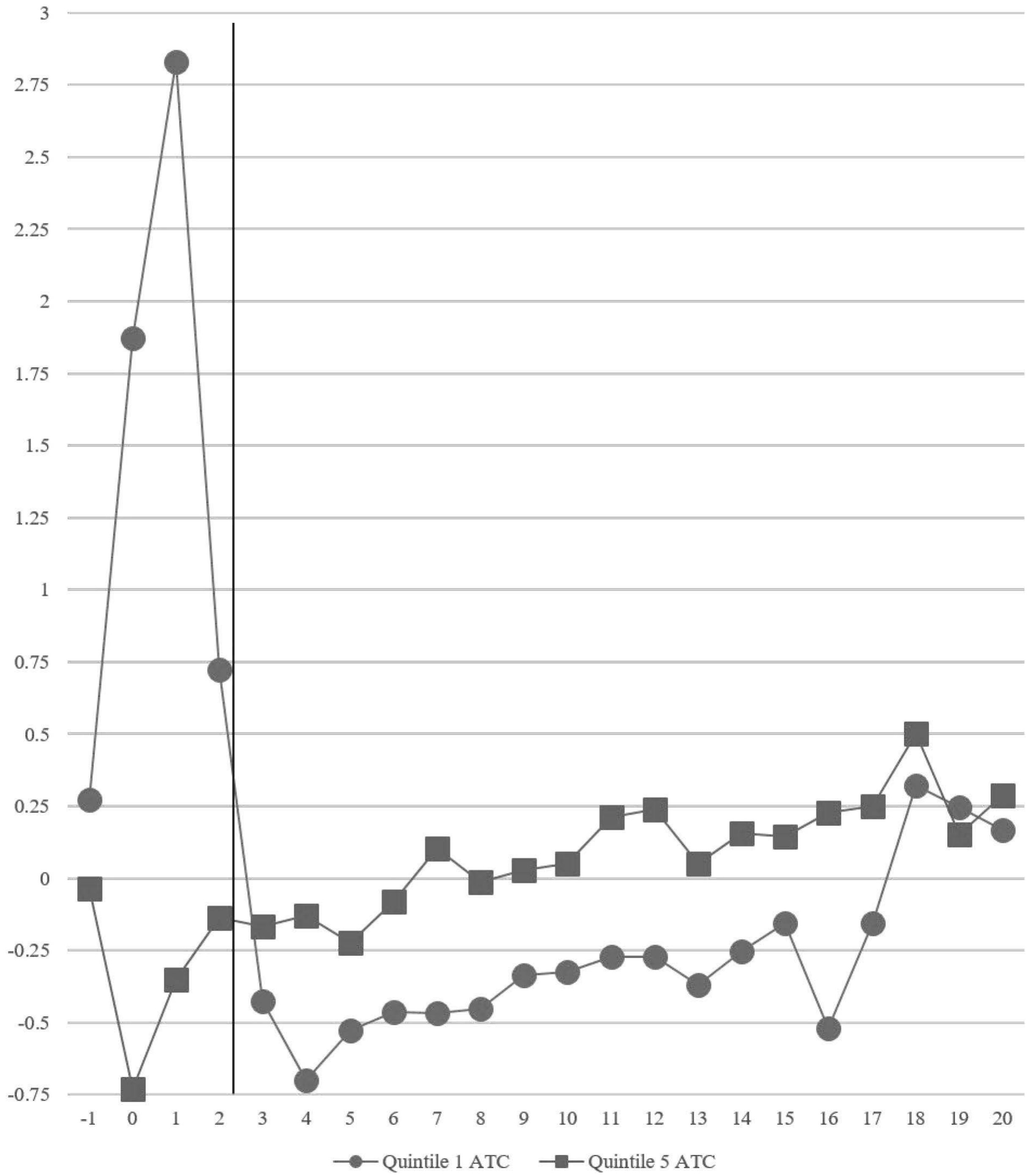

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FIGURE 1 (continued)

Panel B: Daily Volatility

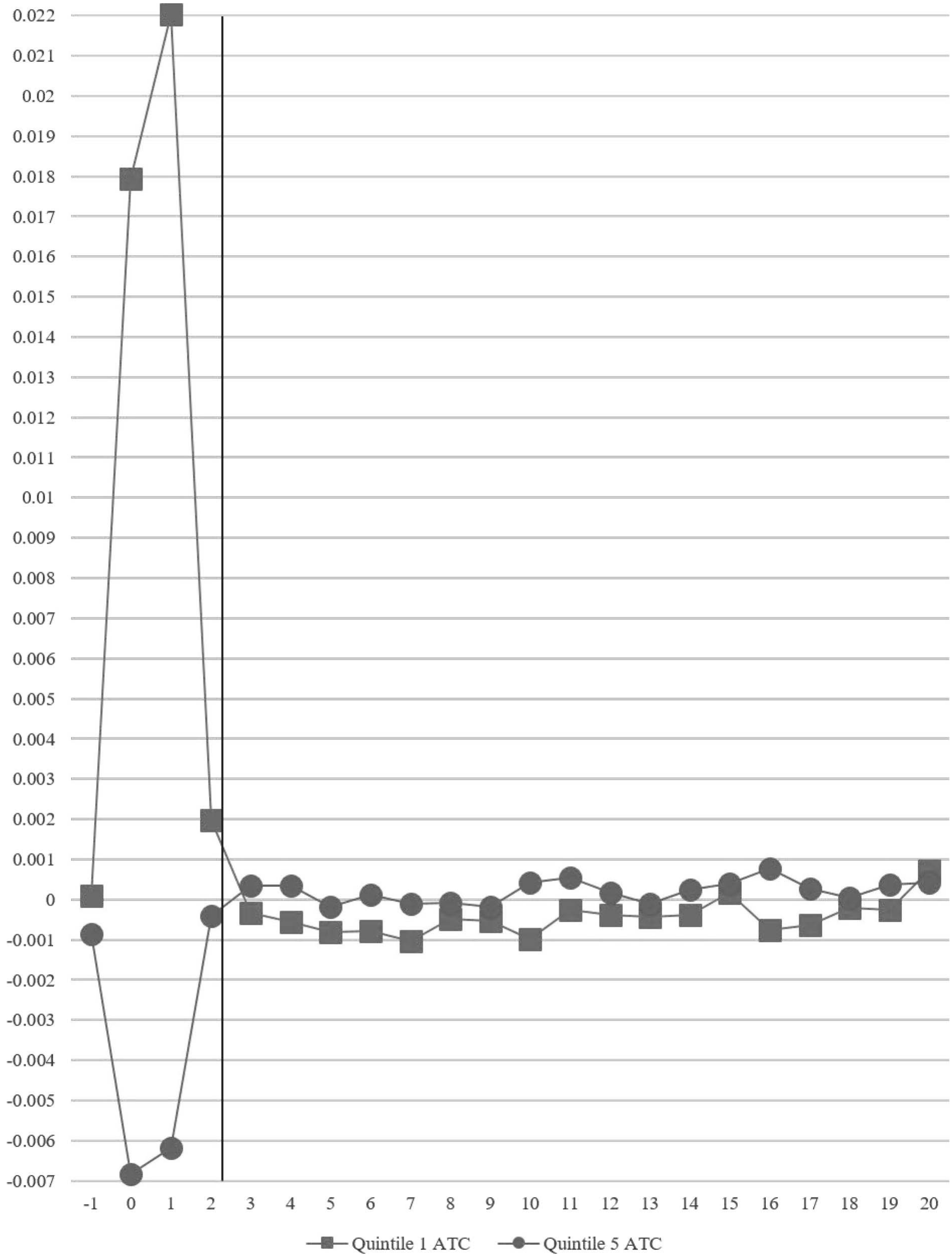

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FIGURE 1 (continued)

Figure 1, Panel A presents daily abnormal volume during the initial (remaining) announcement period, controlling for abnormal volume in the remaining (initial) announcement period. In particular, for days (−1, 2) (days (3, 20)), it presents the means of residuals from regressions of daily abnormal volume on mean daily abnormal volume during the remaining (initial) announcement period for firm-years in the highest and lowest *ATC* quintiles. For each day, abnormal volume is calculated as shares traded over shares outstanding scaled by average daily volume in the pre-announcement period, i.e., *TURN_Pre*. Figure 1, Panel B presents daily abnormal volatility during the initial (remaining) announcement period, controlling for abnormal volatility in the remaining (initial) announcement period. In particular, for days (−1, 2) (days (3, 20)), it presents the means of residuals from regressions of daily abnormal volatility on mean daily abnormal volatility during the remaining (initial) announcement period for firm-years in the highest and lowest *ATC* quintiles. For each day, abnormal volatility is calculated as the squared residual return scaled by average squared daily volatility in the pre-announcement period, i.e., *ASQRET*. The sample comprises 24,310 annual earnings announcements relating to fiscal years ending 1994 to 2011. Daily abnormal volume and volatility are winsorized at the 1st and 99th percentiles.

in the initial and remaining announcement periods, we control for abnormal volume and volatility in the remaining and initial announcement periods as in Equations (6) and (7).

Figure 1, Panel A reveals that from day −1 through day 2, abnormal volume is higher (lower) for firm-years in the lowest (highest) *ATC* quintile, which is consistent with finding the significantly negative α_1 coefficient for Equation (6) presented in Table 4. Panel A also reveals that from day 3 through day 18, abnormal volume is higher (lower) for firm-years in the highest (lowest) *ATC* quintile. This finding not only is consistent with finding the significantly positive α_2 coefficient for Equation (6) presented in Table 4, but also reveals that the finding applies to each day from day 3 through 18. Untabulated statistics reveal that the daily differences are significant for 14 of the 18 days.

Figure 1, Panel B reveals inferences similar to those in Panel A. In particular, Panel B reveals that from day −1 through day 2, abnormal volatility is higher (lower) for firm-years in the lowest (highest) *ATC* quintile, which is consistent with finding the significantly negative α_1 coefficient for Equation (7) presented in Table 4. Panel B also reveals that from day 3 through day 19, abnormal volatility is higher (lower) for firm-years in the highest (lowest) *ATC* quintile. This finding not only is consistent with finding the significantly positive α_2 coefficient for Equation (7) presented in Table 4, but also reveals that the finding applies to each day from day 3 to 19. Untabulated statistics reveal that the daily differences are significant for 8 of the 18 days.

Asymmetric Timeliness and Earnings Announcement Price Changes

Price Discovery

Our findings that asymmetric timeliness is negatively related to resolution of investor disagreement and uncertainty, as reflected in volume and volatility, are consistent with investors taking extra time to assess the implications of earnings for their investment decisions. These findings suggest that greater asymmetric timeliness also can manifest in delayed price discovery.[27]

To test this prediction, we use the price discovery metric from Heflin et al. (2003), absolute cumulative abnormal return, *ACAR*. We compute *ACAR* as follows:

$$ACAR_{i,y,x} = \left|\prod_{s=-1}^{s+x}\left(1 + AR_{i,y,s}\right) - 1\right|, \tag{8}$$

where *AR* is the daily excess return, based on the Fama and French (1993) three-factor model supplemented with the Carhart (1997) momentum factor; day s is relative to the earnings announcement day; and x ranges from 0 to 21.

Figure 2 displays separately for observations in the top and bottom *ATC* quintiles, mean *ACAR* for each day during the full announcement period as a percentage of mean *ACAR* for the full announcement period. By construction, these percentage *ACAR, %ACAR,* equal 1 by the end of the full announcement period. Figure 2 reveals that mean *%ACAR* for observations in the top *ATC* quintile is smaller than that for observations in the bottom *ATC* quintile from the day of the earnings announcement until shortly before the end of the full announcement period. Table 5, Panel A presents statistics relating to tests of differences in mean *%ACAR* between the top and bottom *ATC* quintiles displayed in Figure 2. Panel A reveals that mean *%ACAR* in the top *ATC* quintile is significantly smaller than that in the bottom *ATC* quintile from day 0 through day 11, and insignificantly different from zero thereafter. This pattern of differences in mean *%ACAR* suggests that earnings announcement information is incorporated into stock prices more slowly for firms with higher asymmetric timeliness.

To test our prediction that price discovery is slower for firms with higher *ATC* in a multivariate equation that includes control variables, we estimate a version of Equation (4) in which we replace $EA\_VOLM_{i,y}$ with $ACAR_{i,y,2}$, *ACAR2*. *ACAR2* is

[27] We thank the editor for suggesting we include this analysis and the analysis related to Table 8.

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FIGURE 2
Mean Daily *%ACAR* for Top and Bottom *ATC* Quintiles

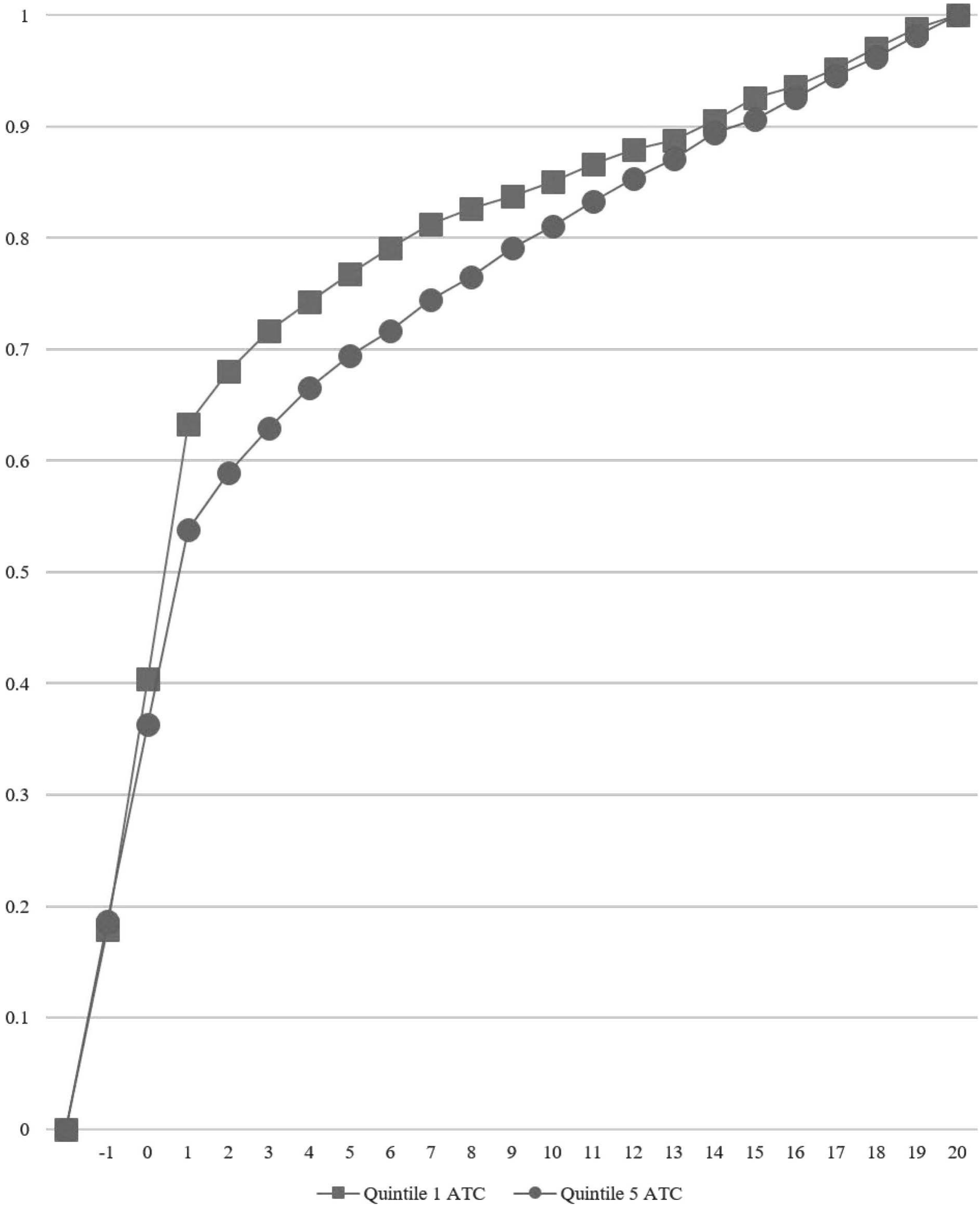

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FIGURE 2 (continued)

Figure 2 displays, separately for observations in the top and bottom *ATC* quintiles, mean daily *%ACAR*, i.e., *ACAR* for each day during the full announcement period as a percentage of mean *ACAR* for the full announcement period. The sample comprises 24,310 annual earnings announcements relating to fiscal years ending 1994 to 2011. Daily *ACAR* are winsorized at the 1st and 99th percentiles.

analogous to *EA_VOLM* and *EA_VOLA* in that *ACAR2* is the absolute cumulative abnormal return in the initial announcement period.[28] Table 5, Panel B, which presents regression summary statistics from this estimation, reveals that the *ATC* coefficient, –0.01, is significantly negative (t-statistic = –1.80). In terms of economic significance, the findings in Table 5, Panel B indicate that holding everything else constant, increasing *ATC* by one standard deviation decreases *ACAR2* by 0.0011 (= –0.01 × 0.11) from its mean of 0.06 to 0.0589, or 2 percent.

Price Drift and Insider Trading

Our findings in Table 3 reveal that greater asymmetric timeliness is associated with greater information uncertainty at earnings announcements. Prior literature suggests that temporary increases in information uncertainty arising from firms' news releases can cause temporary increases in discount rates (Brown, Harlow, and Tinic 1988, 1993; Levi and Zhang 2015).[29] Therefore, we expect firms with earnings exhibiting greater asymmetric timeliness to have larger positive price changes following earnings announcements. However, insiders know whether the firm is experiencing good or bad news and, thus, do not face the same uncertainty that other investors face. As a result, insiders potentially can take advantage of the positive price adjustment by purchasing the firm's shares. Thus, we expect that after the initial earnings announcement period, there will be more net purchases of shares by insiders for firms with greater asymmetric timeliness.

Regarding positive price adjustments, we expect that signed stock returns in the remaining announcement period are positively related with *ATC*. We test this expectation in two ways. First, we form two portfolios based on median *ATC*. For each portfolio, we calculate the mean remaining announcement period compounded signed excess return, *ABRET*(3_20). We compute excess return by subtracting the expected return based on the Fama and French (1993) three-factor model supplemented with the momentum factor from the raw return, provided there are at least 15 non-missing observations. We expect the above-median *ATC* portfolio to earn a larger remaining announcement period return than the below-median *ATC* portfolio. Thus, we test whether mean *ABRET*(3_20) for announcements in the above-median *ATC* portfolio is larger than that in the below-median *ATC* portfolio.

Second, following Core, Guay, and Verdi (2008), we estimate the following annual cross-sectional regression and aggregate coefficients using the Fama and MacBeth (1973) approach.

$$ABRET(3\_20)_{i,y} = \alpha_0 + \alpha_1 ATC_{i,y} + Controls_{i,y} + \varepsilon_{i,y} \tag{9}$$

Because we expect that higher *ATC* is associated with larger *ABRET*(3_20), we expect the *ATC* coefficient, α_1, is positive.

Regarding insider stock purchases, as with positive price adjustment, we conduct two tests. First, we form two portfolios based on median *ATC*. For each portfolio, we calculate the mean of net insider purchases, *Insider_Purch,* the number of shares purchased minus the number of shares sold by all of the firm's insiders (Lakonishok and Lee 2001) during the remaining announcement period, divided by the firm's shares outstanding as of the end of the year (Jagolinzer, Larcker, Ormazabal, and Taylor 2014). Following prior research (Lakonishok and Lee 2001; Jagolinzer et al. 2014), we obtain insider stock transaction information reported on Securities and Exchange Commission (SEC) Form 4, which reports changes in insider ownership, from the Thomson Reuters Insider Filing database. We calculate *Insider_Purch* for all firms with insider trading activity during the calendar year of the earnings announcement. Insiders comprise a firm's officers and directors and any beneficial owners of more than 10 percent of a class of the firm's equity securities. We expect that the above-median (below-median) *ATC* portfolio has larger (smaller) net purchases of stock by insiders during the remaining announcement

[28] Ideally, we would estimate this equation using firm-specific scaled *ACAR*. However, unlike volume and volatility, both of which are positive and hence their sums increase over time, *AR* can be positive or negative and, thus, *ACAR* does not necessarily increase over time. Thus, *ACAR2* is not necessarily a proportion of *ACAR20*. In addition, as Heflin et al. (2003, footnote 11) explain, firm-specific scaled *ACAR* suffer from small-denominator problems. Thus, we rely on the set of control variables we use throughout the study as controls for cross-sectional variation in *ACAR20*.

[29] Brown et al. (1988, 1993) report positive price drift after increases in information uncertainty following the release of news of a financial event. Levi and Zhang (2015) provide evidence of positive price changes in the days preceding earnings announcements that arise from temporary increases in information asymmetry and attendant cost of equity.

TABLE 5

Tests of Differences in Mean *%ACAR* between the Top and Bottom *ATC* Quintiles

Panel A: Tests of Daily Differences in Mean *%ACAR*

	ATC			
Variable	**Quintile 1**	**Quintile 5**	**Difference**	**t-stat**
%ACAR−1	0.18	0.19	−0.01	−1.88
%ACAR0	0.40	0.36	0.04**	5.07
%ACAR1	0.63	0.54	0.10**	8.22
%ACAR2	0.68	0.59	0.09**	7.33
%ACAR3	0.72	0.63	0.09**	6.65
%ACAR4	0.74	0.67	0.08**	5.70
%ACAR5	0.77	0.69	0.07**	5.26
%ACAR6	0.79	0.72	0.07**	5.16
%ACAR7	0.81	0.74	0.07**	4.51
%ACAR8	0.83	0.76	0.06**	4.07
%ACAR9	0.84	0.79	0.05**	2.95
%ACAR10	0.85	0.81	0.04**	2.54
%ACAR11	0.87	0.83	0.03*	2.03
%ACAR12	0.88	0.85	0.03	1.55
%ACAR13	0.89	0.87	0.02	0.99
%ACAR14	0.91	0.89	0.01	0.64
%ACAR15	0.93	0.91	0.02	1.14
%ACAR16	0.94	0.93	0.01	0.56
%ACAR17	0.95	0.95	0.01	0.37
%ACAR18	0.97	0.96	0.01	0.45
%ACAR19	0.99	0.98	0.01	0.37
%ACAR20	1.00	1.00	0.00	0.00

(continued on next page)

period. Thus, we test whether mean *Insider_Purch* for announcements in the above-median *ATC* portfolio is larger than that in the below-median *ATC* portfolio.

Second, we estimate the following equation:

$$Insider\_Purch_{i,y} = \alpha_0 + \alpha_1 ATC_{i,y} + Controls_{i,y} + \varepsilon_{i,y} \quad (10)$$

Because we expect that higher *ATC* is associated with larger insider net purchases during the remaining announcement period, we predict that the *ATC* coefficient, α_1, is positive. Equation (10) includes the same fixed effects as those in Equations (4) and (5).

Table 6, Panels A and B present the results for the positive price adjustment tests. The findings in Panel A relating to the portfolio tests reveal that abnormal return, *ABRET*(3_20), means in the above- and below-median *ATC* portfolios are 0.0071 and 0.0044. As predicted, the difference, 0.0027, is significantly positive (t-statistic = 2.29) and represents an average abnormal return of 27 basis points over an 18-day period. We interpret this abnormal return as corroborating our inference that greater asymmetric timeliness is associated with slower resolution of investor disagreement and uncertainty at earnings announcements, not as a measure of the cost associated with asymmetric timeliness. The findings in Panel B relating to estimation of Equation (9) reveal the same inferences as those based on the findings in Panel A. In particular, the mean *ATC* coefficient is significantly positive (coefficient = 0.05, t-statistic = 2.90).[30]

Table 7, Panels A and B present the results from insider trading tests.[31] The findings in Panel A relating to the portfolio tests reveal that net stock purchases by insiders, *Insider_Purch,* means in the above- and below-median *ATC* portfolios are

[30] Predicting a positive price adjustment for firms with higher *ATC* does not imply a profitable trading strategy based on *ATC*. To show that this is the case, we also estimated Equation (9) using lagged *ATC* in place of *ATC*. Lagged *ATC* is available before the earnings announcement and, therefore, could be used to predict announcement period returns. Untabulated findings indicate that the coefficient on lagged *ATC* is insignificantly different from zero. In addition, finding a significant positive relation between *ATC* and *ABRET*(3_20) is not evidence of post-earnings announcement drift (PEAD). Evidence of PEAD would be a significant positive relation between *EA_RET* and *ABRET*(3_20).

[31] The Table 7 findings are based on 19,219 observations. The smaller sample size reflects lack of insider trading data.

TABLE 5 (continued)

Panel B: Regression Summary Statistics

$$ACAR2_{i,y} = \alpha_0 + \alpha_1 ATC_{i,y} + Controls_{i,y} + \varepsilon_{i,y}$$

Variable	Coefficient	t-stat
ATC	−0.01*	−1.80
Size	−0.00**	−11.51
BM	−0.00**	−9.93
Lev	−0.01**	−3.23
NUMEST	0.00	1.92
MOM	0.00*	2.17
EA_RET	0.04**	3.90
NEG	0.00	1.12
TURN_Pre	0.00**	2.71
SPI	0.00*	2.56
Bundled_Bad	−0.00	−0.92
Revisions	0.00**	4.16
EA_Arts	0.00	0.42
ASQRET	0.06**	9.05
AbsFE	0.31**	4.92
DISP	−0.00**	−3.00
FE	0.05	1.03
RD	0.00*	2.32
FLOSS	0.01*	2.49
TURN_Std	0.01**	5.97
INST	0.00	1.60
Beta	0.00**	3.99
ΔNI	−0.01	−1.35
Observations	24,310	
Adjusted R^2	0.16	

**, * Indicate significance at the 1 percent and 5 percent levels under a one-tailed alternative when we have a signed prediction, and under a two-tailed alternative otherwise.

Panel A presents statistics for tests of daily differences in mean *%ACARx* between the top and bottom *ATC* quintiles, where *%ACARx* is the absolute cumulative abnormal return for each day *x* starting from the day before the earnings announcement, i.e., day −1, divided by the mean absolute cumulative return as of day 20. Panel B presents regression summary statistics for a version of Equation (4) in which we replace *EA_VOLM* with *ACAR2*, where *ACAR2* is the absolute cumulative abnormal return for initial announcement period. The regression includes industry and earnings announcement month-year fixed effects, and the Panel B t-statistics are based on standard errors clustered by firm and earnings announcement month-year. All continuous variables are winsorized at the 1st and 99th percentiles. The sample comprises 24,310 annual earnings announcements relating to fiscal years ending 1994 to 2011.

All other variables are defined in Table 1.

−0.90 and −1.17. As predicted, the difference, 0.27, is significantly positive (t-statistic = 5.46) and is evidence of significantly more insider net purchases for firms with earnings exhibiting greater asymmetric timeliness. However, the findings in Panel B relating to estimation of Equation (10) reveal that the *ATC* coefficient is insignificantly positive (coefficient = 0.22, t-statistic = 0.79), which suggests that net stock purchases by insiders do not manifest in the presence of control variables.

Alternative Approach to Relating Asymmetric Timeliness and Volume and Volatility

Equations (4) and (5) use a measure of asymmetric timeliness to explain cross-sectional variation in our resolution measures, *EA_VOLA* and *EA_VOLM*. We implement an alternative approach in which we estimate the Basu (1997) relation permitting the asymmetric timeliness coefficient to vary with each of our resolution measures. Because the two approaches rest on different assumptions, finding a significantly negative association in each approach increases our confidence in the inferences we draw. Specifically, we estimate the following equations that extend Equation (3):

TABLE 6

Asymmetric Timeliness and Returns in the Remaining Announcement Period

Panel A: By *ATC* Portfolio

	Observations	Mean *ABRET*(3_20)	t-stat
Below Median	12,153	0.0044**	5.60
Above Median	12,157	0.0071**	8.01
Difference		0.0027*	2.29

Panel B: Fama and MacBeth (1973) Statistics from Annual Regressions

$$ABRET(3\_20)_{i,y} = \alpha_0 + \alpha_1 ATC_{i,y} + Controls_{i,y} + \varepsilon_{i,y}$$

Variable	Mean	t-stat
ATC	0.05**	2.90
Size	0.00*	−2.40
BM	0.00	0.81
Lev	−0.01	−1.40
NUMEST	0.00	1.50
MOM	−0.01	−1.64
EA_RET	0.02	1.52
NEG	−0.01**	−2.99
TURN_Pre	0.00	1.15
SPI	0.00	0.67
Bundled_Bad	0.02	0.94
Revisions	0.00	1.72
EA_Arts	0.00	1.43
ASQRET	0.00	0.09
AbsFE	0.15	1.80
DISP	0.00	−1.60
FE	−0.13	−1.45
RD	0.00	1.28
FLOSS	−0.01	−1.18
TURN_Std	0.00*	−2.50
INST	0.00	0.26
Beta	0.00	−0.86
ΔNI	0.01	0.70
Intercept	0.03*	2.21

**, * Indicate significance at the 1 percent and 5 percent levels under a one-tailed alternative when we have a signed prediction, and under a two-tailed alternative otherwise.

Panel A presents mean remaining announcement period returns, *ABRET*(3_20), for portfolios of observations above and below median *ATC*. *ABRET*(3_20) is excess return during the remaining announcement period. We compute excess returns by subtracting the expected return based on the Fama and French (1993) three-factor model supplemented with the momentum factor from the raw return. The t-statistic is associated with tests of whether mean *ABRET*(3_20) for each portfolio or the difference in portfolio means is zero. Panel B presents Fama and MacBeth (1973) summary statistics from annual estimations of Equation (9). All continuous variables are winsorized at the 1st and 99th percentiles. The sample comprises 24,310 annual earnings announcements relating to fiscal years ending 1994 to 2011.

All other variables are defined in Table 1.

$$X_{i,y} = \beta_0 + \beta_1 DR_{i,y} + \beta_2 R_{i,y} + \beta_3 DR_{i,y} \times R_{i,y} + \beta_4 EA\_VOLM_{i,y} \times DR_{i,y} + \beta_5 EA\_VOLM_{i,y} \times R_{i,y} + \beta_6 EA\_VOLM_{i,y} \times DR_{i,y} \times R_{i,y} + Controls_{i,y} + Controls\_Interactions_{i,y} + v_{i,y} \quad (11)$$

$$X_{i,y} = \beta_0 + \beta_1 DR_{i,y} + \beta_2 R_{i,y} + \beta_3 DR_{i,y} \times R_{i,y} + \beta_4 EA\_VOLA_{i,y} \times DR_{i,y} + \beta_5 EA\_VOLA_{i,y} \times R_{i,y} + \beta_6 EA\_VOLA_{i,y} \times DR_{i,y} \times R_{i,y} + Controls_{i,y} + Controls\_Interactions_{i,y} + v_{i,y} \quad (12)$$

TABLE 7

Insider Trading and Asymmetric Timeliness

Panel A: By *ATC* Portfolio

	Observations	Mean *Insider_Purch*	t-stat
Below Median	9,783	−1.17**	−31.89
Above Median	9,431	−0.90**	−26.77
Difference		0.27**	5.46

Panel B: Regression Summary Statistics from Estimating:

$$Insider\_Purch_{i,y} = \alpha_0 + \alpha_1 ATC_{i,y} + Controls_{i,y} + \varepsilon_{i,y}$$

Variable	Coefficient	t-stat
ATC	0.22	0.79
Size	0.28**	6.64
BM	0.43**	5.59
Lev	0.97**	3.83
NUMEST	−0.02	−0.22
MOM	−1.22**	−10.66
EA_RET	−4.17**	−9.57
NEG	0.27**	3.06
TURN_Pre	−0.17*	−2.10
SPI	0.08*	2.05
Bundled_Bad	0.13	1.58
Revisions	−0.09	−1.46
EA_Arts	−0.18**	−5.32
ASQRET	0.90	1.94
AbsFE	0.86	0.31
DISP	0.32**	6.01
FE	−2.78	−1.04
RD	0.06	0.54
FLOSS	0.43*	2.23
TURN_Std	−0.10	−1.42
INST	−0.06	−0.42
Beta	0.04	0.72
ΔNI	0.78*	2.28
Observations	19,219	
Adjusted R^2	0.07	

**, * Indicate significance at the 1 percent and 5 percent levels under a one-tailed alternative when we have a signed prediction, and under a two-tailed alternative otherwise.

Panel A presents mean net insider purchases, *Insider_Purch,* for portfolios of observations above and below median *ATC*. *Insider_Purch* is the number of shares purchased minus the number of shares sold by all of the firm's insiders during the remaining announcement period, divided by shares outstanding as of the end of the year. The t-statistic is associated with tests of whether mean *Insider_Purch* for each portfolio or the difference in portfolio means is zero. Panel B presents summary statistics from Equation (10). The regression includes industry and earnings announcement month-year fixed effects, and the Panel B t-statistics are based on standard errors clustered by firm and earnings announcement month-year. All continuous variables are winsorized at the 1st and 99th percentiles. The sample comprises 19,219 annual earnings announcements relating to fiscal years ending 1994 to 2011.

All other variables are defined in Table 1.

In Equations (11) and (12), the coefficients on $EA\_VOLM \times DR \times R$ and $EA\_VOLA \times DR \times R$, β_6, are the incremental asymmetric timeliness coefficients associated with *EA_VOLM* and *EA_VOLA*. In particular, including $EA\_VOLM \times DR \times R$ and $EA\_VOLA \times DR \times R$ permits the asymmetric timeliness coefficient, β_3, to vary with the speed with which investor disagreement and uncertainty at earnings announcements resolve. We predict that β_6 is negative because we expect that greater

TABLE 8

Permitting Asymmetric Timeliness Coefficient to Vary with Resolution Measures

$$X_{i,y} = \beta_0 + \beta_1 DR_{i,y} + \beta_2 R_{i,y} + \beta_3 DR_{i,y} \times R_{i,y} + \beta_4 EA\_VOLM_{i,y} \times DR_{i,y} + \beta_5 EA\_VOLM_{i,y} \times R_{i,y} + \beta_6 EA\_VOLM_{i,y} \times DR_{i,y} \times R_{i,y} + Controls_{i,y} + Controls\_Interactions_{i,y} + v_{i,y}$$

$$X_{i,y} = \beta_0 + \beta_1 DR_{i,y} + \beta_2 R_{i,y} + \beta_3 DR_{i,y} \times R_{i,y} + \beta_4 EA\_VOLA_{i,y} \times DR_{i,y} + \beta_5 EA\_VOLA_{i,y} \times R_{i,y} + \beta_6 EA\_VOLA_{i,y} \times DR_{i,y} \times R_{i,y} + Controls_{i,y} + Controls\_Interactions_{i,y} + v_{i,y}$$

	EA_VOLM		*EA_VOLA*	
Variable	**Coefficient**	**t-stat**	**Coefficient**	**t-stat**
EA_VOLM × DR × R	−0.13*	−1.69		
EA_VOLA × DR × R			−0.05**	−2.76
Size × DR × R	−0.02**	−3.44	−0.02**	−3.29
BM × DR × R	0.00	0.70	0.00	0.67
Lev × DR × R	0.13**	3.30	0.12**	3.25
NUMEST × DR × R	0.04**	2.91	0.04**	2.76
MOM × DR × R	0.01	0.55	0.01	0.43
EA_RET × DR × R	−0.05	−0.80	−0.04	−0.70
TURN_Pre × DR × R	0.00	0.28	0.00	0.18
SPI × DR × R	0.04**	3.85	0.04**	3.83
Revisions × DR × R	−0.01	−0.93	−0.01	−0.88
Bundled_Bad × DR × R	−0.06**	−3.57	−0.06**	−3.77
EA_Arts × DR × R	0.00	0.65	0.00	0.69
ASQRET × DR × R	−0.05	−0.82	−0.05	−0.79
AbsFE × DR × R	0.79	0.97	0.74	0.90
DISP × DR × R	0.02	1.05	0.02	1.09
FE × DR × R	0.06	0.09	0.08	0.12
RD × DR × R	0.01	0.53	0.01	0.61
FLOSS × DR × R	0.01	0.26	0.01	0.28
TURN_Std × DR × R	−0.00	−0.02	−0.00	−0.08
INST × DR × R	0.03	0.96	0.03	0.97
Beta × DR × R	−0.01	−0.98	−0.01	−0.98
Observations	24,310		24,310	
Adjusted R^2	0.37		0.37	

**, * Indicate significance at the 1 percent and 5 percent levels under a one-tailed alternative when we have a signed prediction, and under a two-tailed alternative otherwise.

Table 8 presents regression summary statistics from estimation of Equations (11) and (12), which permit the asymmetric timeliness coefficient to vary with *EA_VOLM* and *EA_VOLA*. The regressions include industry and earnings announcement month-year fixed effects. All main effects, interactions with *R* and *DR*, and fixed effect interactions with *DR × R* are untabulated. All continuous variables are winsorized at the 1st and 99th percentiles. The table presents t-statistics based on standard errors clustered by firm and earnings announcement month-year. The sample comprises 24,310 annual earnings announcements relating to fiscal years ending 1994 to 2011.

All variables are defined in Table 1.

asymmetric timeliness is associated with slower resolution. *Controls* is the same set of variables as that in Equations (6) and (7), and *Controls_Interactions* is the set of interactions between *Controls* and *R, DR,* and *DR × R*.[32] Equations (11) and (12) also include the same fixed effects as those in Equations (4) and (5) and their interactions with *R, DR,* and *DR × R*.

Table 8 presents selected regression summary statistics for Equations (11) and (12). In particular, we tabulate the coefficients for *EA_VOLM × DR × R* and *EA_VOLA × DR × R,* and for the interactions of *DR × R* with each of the control variables other than the fixed effects.[33] The key findings are that, as predicted, β_6 is significantly negative in both estimations.

[32] Equations (11) and (12) exclude *NEG* and ΔNI because earnings is the dependent variable in these equations, and including these variables effectively would partition observations based on the dependent variable.

[33] There are 13 industries, 220 earnings announcement month-years, 20 control variables, and *EA_VOLM* or *EA_VOLA,* each of which is included as a main effect and interacted with *R, DR,* and *DR × R*. For the sake of parsimony, we do not tabulate the coefficients for 1,016 explanatory variables.

In particular, for the *EA_VOLM* interaction, $\beta_6 = -0.13$ (t-statistic $= -1.69$), and for the *EA_VOLA* interaction, $\beta_6 = -0.05$ (t-statistic $= -2.76$).

VI. CONCLUSION

We predict and find that greater asymmetric timeliness of earnings in recognizing good and bad news is associated with slower resolution of equity investor disagreement and uncertainty at earnings announcements. These findings suggest that a potential cost of asymmetric timeliness is the increased time it takes investors to assess the implications of the earnings announcement for their investment decisions, which, in turn, impedes the speed with which investor disagreement and uncertainty resolve.

To test our prediction, we develop a measure of asymmetric timeliness that varies cross-sectionally and intertemporally and examine whether it is negatively related to our resolution measures. Our resolution measures are the ratios of the sums of daily volume or volatility during the initial annual earnings announcement period to the respective volume or volatility amount in the full announcement period. Lower ratios indicate that investor disagreement and uncertainty resolve more slowly. We also test our prediction by estimating the Basu (1997) relation, permitting the asymmetric timeliness coefficient to vary with our resolution measures. The findings support our inferences that greater asymmetric timeliness is associated with slower resolution of investor disagreement and uncertainty at earnings announcements.

Finding delayed resolution of investor disagreement and uncertainty at earnings announcements suggests that asymmetric timeliness also could delay price discovery. Consistent with this possibility, we find a significantly negative relation between our asymmetric timeliness measure and absolute cumulative abnormal return during the initial announcement period. We also predict and find that stock returns after the initial announcement period are positively related with our measure of asymmetric timeliness. This finding is consistent with earnings exhibiting greater asymmetric timeliness being more complex for investors to assess, which results in greater information uncertainty and, in turn, temporary increases in discount rates. We also predict, but do not find clear evidence, that insiders take advantage of the positive price adjustment by purchasing the firm's shares.

Taken together, our findings provide evidence that asymmetric timeliness of earnings in recognizing good and bad news can entail costs arising from the additional time it takes for investors to discern the implications for their investment decisions of earnings when they are announced.

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