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Chapter 2

Do Managers Use Earnings Forecasts to Fill a Demand They Perceive from Analysts?

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Abstract

This paper examines how the nature of the information possessed by individual analysts influences managers' decisions to issue forecasts and the consequences of those decisions. Our analytical model yields the prediction that managers prefer to issue guidance when they perceive their private information to be more precise, and analysts possess mostly common, imprecise information (i.e., there is high commonality and uncertainty). Based on an econometric model, we obtain theory-based analyst variables and our empirical evidence confirms our predictions. High commonality and uncertainty in analysts' prior information are accompanied by increases in analysts' forecast revisions and trading volume following guidance, consistent with greater analyst incentives to generate idiosyncratic information. Yet, management guidance increases only with the commonality contained in analysts' pre-disclosure information, but not with the level of uncertainty. Indeed, the disclosure propensity among a subset of firms (those with less able managers, bad news, and infrequent forecasts) has an inverse relationship with analyst uncertainty due to its reflection on the low precision of management information. Our results are robust to a variety of alternative analyses, including the use of propensity-score matched pairs with similar disclosure environments but differing degrees of commonality and uncertainty among analysts. We also demonstrate that the use of forecast dispersion as an empirical proxy for analysts' prior information may lead to erroneous inferences. Overall, we define and support improved measures of analyst information environment based on an econometric model and find that the commonality of information among analysts acts as a reliable forecast antecedent by informing managers about the amount of idiosyncratic information in the market.

Keywords

Management earnings forecasts • Analysts' information • Uncertainty • Commonality.

2.1 Introduction

Anecdotes and empirical research suggest that managers often issue guidance to ensure sell-side consensus forecasts and market expectations are reasonable and fill a demand they perceive from analysts.[1] Specifically, management uses its earnings forecasts as a device to walk-down analysts' consensus forecasts to avoid penalties associated with failing to meet analysts' expectations (Matsumoto, 2002; Richardson, Teoh, and Wysocki, 2004; and Cotter, Tuna, and Wysocki, 2006). Poor alignment of analysts' expectations often leads to the decision to stop earnings guidance (Feng and Koch, 2010; Houston, Lev, and Tucker, 2010; and Chen, Matsumoto, and Rajgopal, 2011). Despite evidence on the use of earnings guidance as a tool to facilitate expectation alignment, relatively little is known about how management earnings guidance strategy is affected by market participants' incentives to develop private information. Since market participants possess different prior beliefs or likelihood functions (Barron, Byard, and Kim, 2002), an important problem facing the managers is how to issue earnings forecasts to influence idiosyncratic beliefs among market participants and, in turn, security prices. In this paper, we examine how the nature of the information possessed by individual analysts influences managers' decisions to issue forecasts and the consequences of those decisions.

Previous studies examine the relation between management guidance and two proxies for analysts' information environment: analyst coverage and forecast dispersion. Empirical evidence relating to this issue is limited and mixed. For example, Houston *et al.* (2010) and Chen *et al.* (2011) find that firms with decreasing analyst following are more likely to stop providing earnings guidance. Although an unstated reason for this stoppage could be poor performance and repeated consensus misses, stoppers that publicly announced the decision to stop guidance did not experience a change in analyst coverage. Balakrishnan *et al.* (2014) examine losses of analyst coverage (i.e., closures of brokerage operations) that are unrelated to individual firms' future prospects and show that firms respond to the exogenous shocks by providing more timely and informative earnings guidance and that such efforts improve trading liquidity. In the absence of significant coverage termination events, a firm's analyst following does not often change quickly, while analysts constantly attempt to produce information from various sources (Brown *et al.* 2014). We explore how variation in analysts' incentives to develop private information affects managers' decision to forecast (while the level of analyst following is held constant).

[1]According to a 2009 forward-looking guidance practices survey by the National Investor Relations Institute among its public company members, the primary reason for issuing guidance is to ensure sell-side consensus and market expectations are reasonable (http://www.niri.org/findinfo/Guidance.aspx).

Forecast dispersion, on the other hand, likely captures various different aspects of analysts' information environment. For example, Cotter *et al.* (2006) and Feng and Koch (2010) suggest that management guidance is less likely as the dispersion in analyst forecasts increases, whereas Houston *et al.* (2010) suggest that high dispersion is one of the antecedents related to stopping guidance. Both Houston *et al.* (2010) and Chen *et al.* (2011) find that analyst forecast dispersion and forecast error increase following the stoppage of guidance. Seen in those contexts, dispersion is referred to as a "catch-all" information proxy for a number of different constructs, such as analyst herding, information asymmetry, and forecasting uncertainty. Barron, Stanford, and Yu (2009) suggest that dispersion captures various constructs to a different degree and its appropriateness as a proxy for a given factor varies by the setting and empirical specification. This argument is confirmed by our econometric model, which reveals that dispersion is only one component of analyst information environment. It is clearly not possible from those studies to determine the effect of analysts' private information incentives on management guidance practices.

We infer market participants' incentives to develop private information from the nature of the information contained in individual analysts' forecasts and, more specifically, analysts' level of uncertainty and the commonality of their beliefs. Sell-side financial analysts serve as sophisticated processors of accounting disclosures, whose primary role in the capital markets is to search, analyze, and interpret information about industry trends, company strategy, and profit potential to generate value for their clients and themselves (Brown *et al.*, 2014). If individual forecasts convey relatively little idiosyncratic information (i.e., there is high commonality), analysts would seek to develop more uniquely private information in their forecasts to maintain competitive advantages or obtain trading profits (Barron *et al.*, 2002). Analysts' career advancement is also affected by their forecast accuracy (Mikhail, Walther, and Willis, 1999; and Wu and Zang, 2009). High levels of uncertainty in individual analysts' information (i.e., lack of precision) would stimulate analysts to create new information to increase forecast precision (Frankel, Kothari, and Weber, 2006).

Relying on a simple theoretical model, we predict that managers prefer to issue guidance when they perceive their private information to be more precise, and analysts possess mostly common, imprecise information. We maintain that higher analysts' incentives to develop private information will lead to more analysts' effort and the processing of more public disclosures. Alternatively, as commonality and uncertainty of information among analysts increase, managers likely feel increasing pressure to provide guidance to fill the demand they perceive from analysts. Yet, since management has different goals than analysts, analysts' incentives may be in significant conflict with managers' personal goals. The intuition underlying our proposition is that the decision to forecast depends not only on analysts' incentives to develop private information, but also on the precision of management's private information. When the level of uncertainty among analysts is high, managers similarly face significant constraints that could preclude them from disclosure, such as a lack of information precision or an inability to predict future changes themselves. To the extent that analysts' uncertainty corresponds with low information precision faced by managers, managers may not always desire to issue new forecasts.

Based on improved empirical measures obtained from our econometric model, we present evidence that confirms our predictions. We find that managers provide more guidance when pre-disclosure commonality among analysts' beliefs is high. We corroborate this finding by showing that managers are more likely to issue forecasts when the precision of analysts' common (idiosyncratic) information is high (low). These findings support the view that analysts possess an innate tendency or desire to develop private information of their own and management guidance is provided to fit this specific need of analysts. We also find that high uncertainty among analysts sometimes prompts less disclosure due, at least in part, to its correlation with the (unobservable) uncertainty contained in managers' information. The inverse relation between uncertainty and guidance is mostly driven by firms whose managers have low ability, firms that provide infrequent guidance, and firms that report bad earnings news. Our results continue to hold in propensity-score matched pairs with similar disclosure environments but differing degrees of commonality and uncertainty among analysts.

Our results also largely support the conjecture that the uncertainty and the commonality of information contained in individual analysts' earnings forecasts lead to more analysts' effort and the generation of idiosyncratic information. We find that high commonality and uncertainty in analysts' prior information are accompanied by increases in analysts' forecast revisions and trading volume following guidance. These findings suggest that analysts and investors revise their beliefs differentially according to the properties of pre-disclosure information in the market. The differential belief revision around management forecasts arises from a lack of both diversity and uncertainty in market participants' prior information. We demonstrate that the use of dispersion as an empirical proxy for analysts' prior information may lead to erroneous inferences such as no variation in market reactions conditional on analysts' prior information.

Taken together, our results suggest that market participants' incentives to develop private information is a reliable forecast antecedent and that the market's differential interpretation of management earnings forecasts leads to subsequent analyst forecast revision and significant trading. The commonality of information among analysts based on our econometric model is the best empirical measure of market participants' incentives to develop private information, because it reflects solely the amount of idiosyncratic information in the market and not management attributions and has a significant effect on managers' decision to forecast. Analysts' uncertainty is correlated with that of managers (an omitted factor) making it difficult to infer how the nature of analysts' information affects managers' disclosure decisions.

This paper contributes to the literature in several important ways. First, we add to the literature on management's forecast decisions by providing evidence on the role of market participants' incentives to develop private information in motivating managers to supply guidance. Although studies have looked at the general relation between management earnings forecasts and analysts' information environment (Feng and Koch, 2010; Houston *et al.*, 2010; and Chen *et al.*, 2011), none have addressed how the decision to forecast is affected by the idiosyncratic element of analysts' prior information. Our study provides additional insights beyond prior studies in this area that the commonality of analysts' prior information acts as a more reliable forecast antecedent (compared to other alternatives such as levels of uncertainty and forecast dispersion) and that managers care about the amount of idiosyncratic information in the market.

Second, we add to prior research on the effect of earnings announcements on belief revisions to include the disclosure of managers' forecasts. Barron *et al.* (2002) show that earnings releases trigger the generation of idiosyncratic information by financial analysts, and Bamber, Barron, and Stober (1999) show that analysts' idiosyncratic interpretations of the disclosure lead to more informed trading. We find a positive association between the commonality and uncertainty of information among analysts and analyst forecast revisions and trading volume pursuant to management forecast releases. Our findings suggest that either high uncertainty or high commonality may induce analysts to move out of their comfort zone and actively seek out management-provided information to develop new idiosyncratic information.

Finally, this paper contributes to the literature on managers' walking-down of analysts' forecasts over the horizon (Cotter *et al.*, 2006) by demonstrating a different side of the "game" between analysts and managers. Our findings that analysts' incentives to develop private information explain why managers choose to forecast and what the resulting forecast consequences are suggest that managers can strategically forecast to achieve a desired result. Hence, our results are relevant to the debate about whether firms should discontinue guidance to analysts due to the potential myopic incentive effects created by providing guidance (Houston *et al.*, 2010; and Chen *et al.*, 2011).

The rest of the paper is organized as follows. Section 2.2 provides a simple disclosure model and motivates the hypotheses to be tested. Section 2.3 presents the econometric model behind our analyst information environment proxies and Section 2.4 discusses the research design. Section 2.5 provides the sample selection and descriptive statistics and Section 2.6 discusses the empirical results. Finally, Section 2.7 concludes.

2.2 A Simple Model

The prior research on managerial disclosure incentives in connection with analysts' interest has focused on incentives to bias analyst outputs. Whereas managers use their earnings forecasts to strategically manage the analysts' consensus earnings forecasts (Fuller and Jensen, 2002), analysts have a tendency to curry favor with management due to the importance of maintaining strong relationships with management and generating brokerage revenues (Lim, 2001; O'Brien, McNichols, and Lin, 2005; Cowen, Groysberg, and Healy, 2006; and Brochet, Miller, and Srinivasan, 2014).

While the prior research suggests a game between management and analysts, analysts have many competing incentives tied to their information role in capital markets. Analysts generally have an interest in building a good reputation for issuing accurate forecasts, signaling private information, and maximizing trading the stocks they cover (Beyer *et al.*, 2010). Prior research suggests that analysts seek and assess management disclosure, and expanded disclosure creates additional analyst and investor interest in the stocks (Healy, Hutton, and Palepu, 1999), implying that managers have incentives to increase analysts' ability to effectively understand and forecast the firm. However, evidence on the direct interplay between the nature of analysts' prior information and management voluntary disclosure response is limited.

The existing literature suggests two properties of analysts' information environment, which may be indicative of their incentives to develop private information — the levels of commonality and uncertainty among analysts. High commonality in analysts' beliefs indicates that either analysts lack private information or that they do not fully use their private information when issuing forecasts (Barron *et al.*, 1998, BKLS hereafter; and Clement and Tse, 2005). Moreover, Brown *et al.* (2014) find that issuing forecasts below consensus earns analysts credibility with their clients, rather than negatively impacting their compensation or career opportunities. Building on the Indjejikian (1991) and Fischer and Verrecchia (1998) models about analysts' motives to increase the idiosyncratic information in their forecasts, Barron *et al.* (2002) suggest that an important role of accounting disclosures is to trigger the generation of idiosyncratic information by financial analysts, which decreases the commonality in their information. Increased public disclosure also increases investor demand for idiosyncratic interpretations of the disclosure and, accordingly, analysts expect greater profits from trading on their private information.

Prior research suggests that uncertainty in the information environment adversely impacts analysts' forecast accuracy (Zhang, 2006; and Amiram *et al.*, 2013). There is a higher probability of job changes for analysts whose forecast accuracy is lower than that of their peers (Mikhail *et al.*, 1999; and Hong, Kubik, and Solomon, 2000). However, Frankel *et al.* (2006) find that the informativeness of analyst research increases with stock return volatility, suggesting high uncertainty presents analysts with more opportunity to gain from information acquisition. Waymire (1986) and Clement, Frankel, and Miller (2003) show that management forecasts improve posterior analyst forecast accuracy and reduce analyst forecast dispersion, indicating reduced uncertainty about future earnings.

We provide a stylized framework to demonstrate the theoretical underpinnings of our hypotheses about the effects of analyst' information environment on management voluntary disclosure decisions.[2] Consider the following setting. A firm has underlying earnings with states being either high or low (x_L or x_H). The manager of the firm learns some private but imperfect information s that is stochastically associated with the underlying earnings and characterized by its precision, r. There is no credible way for the manager to convey his private information to the capital market directly due to the non verifiable nature of the information, but he has the option to issue a voluntary disclosure based on that information. Thus, the voluntary disclosure

[2]For expositional purposes, we focus on the intuition here and relegate the technical description to the Appendix 2A.

(or lack of) potentially conveys information about the manager's private information, and further, true earnings. The price of the firm is determined by risk-neutral investors' inference of the firm's value based on the manager's disclosure. Later, the underlying earnings are revealed. If the underlying earnings are not contained in the manager's voluntary disclosure, the manager will need to pay a personal penalty, c. The manager tries to maximize a fraction, α, of the share price at the voluntary disclosure stage, net the expected penalty for a "faulty" voluntary disclosure.

Because the state of nature is binary, the only two possible voluntary disclosures are (1) silence, interpreted in equilibrium as earnings being either high or low; and (2) the earnings is high. Provided that the expected probability of incurring a penalty associated with voluntarily disclosing earnings being high is a decreasing function of the manager's information,[3] an equilibrium exists where the manager applies a switching-strategy: if the manager observes a sufficiently high signal, he voluntarily discloses that earnings is high; otherwise, he remains silent. The intuition goes as follows. The manager faces the following tradeoff when determining his voluntary disclosure choices: disclosing that earnings is high has the benefit of a higher share price, but also increases the probability of bearing a penalty because the realization of the true earnings may be low. If the manager observes a sufficiently high signal, the probability of a future penalty is sufficiently low, and the benefit from the inflated price of disclosing high earnings outweighs the expected penalty. In contrast, if the signal is sufficiently low, the posterior probability of incurring a penalty is high, and the expected cost of realizing low earnings outweighs the benefits from the inflated price of disclosing high earnings. The manager then rationally chooses to keep silent.

In this equilibrium, the threshold at which the manager decides to make a voluntary disclosure or remain silent satisfies: $s^* = \frac{1+\mathrm{r}}{2\mathrm{r}} - \alpha\frac{x_H - x_L}{2c}$. Furthermore, it is intuitive that the probability of issuing earnings guidance increases (i.e., the threshold value, s^*, decreases) as (1) the responsiveness of manager's utility to the share price increases ($\frac{\partial s^*}{\partial \alpha} < 0$), and (2) the manager's private information becomes more precise ($\frac{\partial s^*}{\partial r} < 0$). Within the context of this paper, the fraction α captures to some extent market participants' incentives to develop private information. It represents a variable unrelated to the asset's true, economic value, but which nonetheless affects

[3]This is a standard assumption in the literature that makes the private information informative.

the manager's payoff arising from his own disclosure choice. A greater α may dampen the effect of disclosure on price change through the generation of new idiosyncratic information from the public announcement. As analysts' incentives to impound idiosyncratic information in their forecasts increase, analysts are more likely to react to the information contained in management earnings forecasts (i.e., revising their forecasts). Likewise, the stock market will react more strongly to management forecasts as investors are likely to uncover more idiosyncratic interpretations of the disclosure (such as those provided by analysts). As a result, managers' utility becomes more responsive to market's demand for management guidance.[4]

Whereas we focus primarily on the interpretations of α and r, the analysis also indicates that the threshold value increases with the expected penalty for a "faulty" voluntary disclosure ($\frac{\partial s^*}{\partial c} > 0$). The penalty c is simply introduced as a constraint on manager's voluntary disclosure.

Our model suggests that managers prefer to issue guidance when market participants' incentives to develop private information are high (i.e., a higher α) and their private signal is more precise (i.e., a higher r). The comparative static result of $\frac{\partial s^*}{\partial \alpha} < 0$ implies that when there is little idiosyncratic information in the market, the manager responds by lowering the disclosure threshold. This interpretation is consistent with public announcements creating idiosyncratic beliefs in Barron *et al.* (2002), in which earnings announcements trigger generation of new idiosyncratic information by financial analysts. As discussed earlier, there are two major instances of increasing analysts' (as the primary market agents) incentives to develop private information: when the degree of commonality or uncertainty among analysts is high.

However, the parameter r in the model captures the manager's overall information uncertainty about the underlying earnings. The comparative statics result of $\frac{\partial s^*}{\partial r} < 0$ suggests that as the precision of management's private signal decreases, the preferred disclosure policy *ex ante* leans toward that of a non disclosure. This prediction is consistent with managers caring about the errors in their earnings forecasts (Beyer, 2009). In the context

[4]Our framework is essentially a good news disclosure story as Dye (1985) and Jung and Kwon (1988), i.e., good news is disclosed, and bad news is suppressed. The stronger market's demand for new information increases the impact that manager's disclosure has on the increase in the share price. As a result the firm may award the manager more shares in the manager's compensation package to incentivize him to disclose, or the manager may choose to exercise more of his existing options due to the increase in share price in response to disclosure.

of our study, managers may withhold information when their incentives (reducing their forecast errors) are partially misaligned with the goal of analysts such as in the case of high information uncertainty. Prior theoretical work also suggests that uncertainty prevents full disclosure in equilibrium as managers themselves may lack the information, or lack the ability to predict changes (Verrecchia, 2001).[5]

In short, the presence of high commonality among analysts increases the likelihood of a forecast being issued to fit analysts' incentives to develop new idiosyncratic information, whereas the existence of high uncertainty may either encourage or inhibit the disclosure because of possible misalignment in the manager's and analysts' incentives (e.g., accurate reporting vs. information seeking). The above discussion leads to two testable empirical predictions:

Hypothesis 2.1 The commonality among analysts' beliefs increases the likelihood of a firm issuing management earnings forecasts.

Hypothesis 2.2 The level of analysts' earnings forecast uncertainty does not influence the likelihood of a firm issuing management earnings forecasts.

2.3 The Econometric Model

This section presents the full econometric model, summarized in Sheng and Thevenot (2012) and derives the constructs of analyst commonality and uncertainty that exists at the time a forecast is made. For N analysts, T target years, H forecast horizons, let F_{ith} be the h-quarter ahead of earnings forecast made by analyst i, for target year t. If A_t is the actual earnings, then analyst i's forecast error e_{ith} can be defined as

$$e_{ith} = A_t - F_{ith}. \tag{2.1}$$

Following Davies and Lahiri (1995), we write e_{ith} as the sum of a common component, λ_{th} and an idiosyncratic error, ε_{ith}:

$$e_{ith} = \lambda_{th} + \varepsilon_{ith}, \tag{2.2}$$

[5]For example, Dye (1985) suggests that information is withheld because there is doubt about whether the manager is informed or, equivalently, whether the information in question has yet to arrive. Trueman (1986) and Verrecchia (1990) suggest that executives may abstain from disclosure due to lack of confidence in their ability to predict future changes or concerns about the adverse effects of inaccuracies such as increased litigation risk and market volatility.

where

$$\lambda_{th} = \sum_{j=1}^{h} u_{tj}. \tag{2.3}$$

The idiosyncratic errors, ε_{ith} arise from analysts' private information and differences in their information acquisition, processing, interpretation, judgment and forecasting models. The common component, λ_{th} denotes forecast errors that all analysts would make due to the unpredictable events that affect target earnings and occur from the time the analyst issues a forecast until the end of the time over which target earnings are realized. These shocks could be economy-wide, like the events of September 11, 2001, or firm-specific events, like an unanticipated merger, loss of a major customer or bankruptcy. Equation (2.3) shows that this accumulation of shocks is the sum of each quarterly shock, u_{tj} that occurs between the time the analyst releases a forecast and the end of the fiscal period over which earnings are realized. Hence, even if analysts make "perfect" forecasts, i.e., they have perfect private information, the forecast error may still be non-zero due to shocks which are, by nature, unpredictable, but nevertheless affect target earnings.

In line with Lahiri and Sheng (2010), we make the following simplifying assumptions:

Assumption 1 (Common Component). $E(u_{tj}) = 0$; $\text{var}(u_{tj}) = \sigma^2_{u_{tj}}$ for any t and j; $E(u_{tj}u_{ts}) = 0$ for any t and $j \neq s$; $E(u_{th}u_{t-k,h}) = 0$ for any t, h and $k \neq 0$.

Assumption 2 (Idiosyncratic Component). $E(\varepsilon_{ith}) = 0$; $\text{var}(\varepsilon_{\text{ith}}) = \sigma^2_{\varepsilon_{ih}}$ for any i, t and h; $E(\varepsilon_{ith}\varepsilon_{jth}) = 0$ for any t, h and $i \neq j$.

Assumption 3 (Identification Condition). $E(\varepsilon_{ith}u_{t-k,j}) = 0$ for any i, t, h, k and j.

Assumption 1 implies that the unanticipated shocks are uncorrelated over time and horizons. The idiosyncratic errors are taken to be mutually independent (Assumption 2). In addition, the common component and idiosyncratic disturbances are assumed to be independent (Assumption 3). Taken together, Assumptions 1 to 3 allow the individual forecast error to be decomposed into a common and idiosyncratic component as specified in equations (2.2) and (2.3). Note that the model structure and assumptions described above are similar to the model of Abarbanell *et al.* (1995) that assumes an exogenous individual forecast with two error terms: one common and one idiosyncratic.

As in previous research, the observed dispersion among analysts, d_{th} is expressed as

$$d_{th} \equiv \frac{1}{N}\sum_{i=1}^{N}(F_{ith} - F_{\bullet th})^2, \tag{2.4}$$

where $F_{\bullet th} = \frac{1}{N}\sum_{j=1}^{N} F_{jth}$ is the mean forecast averaged over analysts.

As Lahiri and Sheng (2010) suggest, the uncertainty associated with a forecast of any given analyst is measured by the variance of the individual forecast errors, which, given equations (2.1) and (2.2), can be expressed as the sum of the volatilities in each error component:

$$U_{ith} \equiv \mathrm{Var}(e_{ith}) = \mathrm{Var}(\lambda_{th} + \varepsilon_{ith}) = \sigma^2_{\lambda_{th}} + \sigma^2_{\varepsilon_{ih}}, \tag{2.5}$$

where $\sigma^2_{\lambda_{th}} = \mathrm{Var}(\lambda_{th})$. An individual analyst's forecast uncertainty in equation (2.5) is comprised of two components: uncertainty associated with forthcoming shocks, $\sigma^2_{\lambda_{th}}$, which is common to all analysts, and the variance of his idiosyncratic error, $\sigma^2_{\varepsilon_{ih}}$. In line with BKLS, we measure overall forecast uncertainty, U_{th}, as the average of the individual forecast error variances, which can be interpreted as the uncertainty associated with a typical analyst's forecast. Therefore, U_{th} can be expressed as:

$$U_{th} \equiv \frac{1}{N}\sum_{i=1}^{N} U_{ith} = \sigma^2_{\lambda_{th}} + \frac{1}{N}\sum_{i=1}^{N}\sigma^2_{\varepsilon_{ih}}. \tag{2.6}$$

Alternatively, in the absence of individual forecast bias, i.e., if $E(A_t - F_{ith}) = 0$, U_{th} is equal to the expectation of the average squared individual forecast errors.[6] Following Engle (1983), we decompose the average squared individual forecast errors as:

$$\frac{1}{N}\sum_{i=1}^{N}(A_t - F_{ith})^2 = (A_t - F_{\bullet th})^2 + d_{th}. \tag{2.7}$$

[6]Prior research suggests that analysts are optimistically biased (Francis and Philbrick, 1993). More recent studies show that individual forecast bias has decreased over time (Matsumoto, 2002), decreases over the forecast horizon (Richardson, Teoh and Wysocki, 2004), and is more pronounced for firms reporting losses (Brown, 2001). However, as we discuss later in Section 4, with the GARCH model estimation, any systematic bias in the mean forecast errors will be included in the model intercept and eliminated from the estimate of common uncertainty.

Taking expectations on both sides, given all available information at time $t - h$ including F_{ith} and d_{th}, we get the following conditional relationship between uncertainty, the variance of mean forecast errors and observed dispersion:

$$U_{th} = E(A_t - F_{\bullet th})^2 + d_{th}. \tag{2.8}$$

The first term on the right-hand side of equation (2.8) can alternatively be written as (Markowitz 1959, p. 111):

$$\begin{aligned} E(A_t - F_{\bullet th})^2 = {} & \frac{1}{N^2}\sum_{i=1}^{N} E(A_t - F_{ith})^2 \\ & + \frac{1}{N^2}\sum_{i=1}^{N}\sum_{j\neq i}^{N} E(A_t - F_{ith})(A_t - F_{jth}). \end{aligned} \tag{2.9}$$

Under Assumption 3, that is, the independence between the common and idiosyncratic error components, equation (2.9) can be expressed as:

$$E(A_t - F_{\bullet th})^2 = \sigma^2_{\lambda_{th}} + \frac{1}{N^2}\sum_{i=1}^{N}\sigma^2_{\varepsilon_{ih}}. \tag{2.10}$$

Note that as the number of forecasters gets large, the second term on the right hand side will be close to zero and the uncertainty about the mean forecast $E(A_t - F_{\bullet th})^2$ will reflect only the uncertainty in common information, $\sigma^2_{\lambda_{th}}$.

Substituting equation (2.10) in (2.8), we obtain

$$U_{th} = \sigma^2_{\lambda_{th}} + d_{th} + \frac{1}{N^2}\sum_{i=1}^{N}\sigma^2_{\varepsilon_{ih}}. \tag{2.11}$$

For large values of N, the last term on the right-hand side of equation (2.11) will be close to zero and can be ignored. Hence, given the model assumptions and for large values of N, *ex ante* forecast uncertainty, dispersion and the variance of forthcoming aggregate shocks are expected to be related as in the following proposition.

Proposition 1: Suppose Assumptions 1–3 hold and N is large. Then earnings forecast uncertainty can be expresses as:

$$U_{th} = \sigma^2_{\lambda_{th}} + d_{th}. \tag{2.12}$$

The proposition shows that the difference between uncertainty and dispersion will be determined partly by the length of the forecast horizon over which the unanticipated shocks accumulate — the longer the forecast horizon the bigger the difference on average because $\sigma^2_{\lambda_{th}} > \sigma^2_{\lambda_{tk}}$ for $h > k$. It also suggests that the robustness of the relationship between the two will depend on the variability of the aggregate shocks over time, i.e., if the time period is volatile, then dispersion would be a noisy measure of uncertainty.

Note that Barry and Jennings (1992, p. 173) and BKLS (p. 425) derive a similar relationship between uncertainty and dispersion:

$$U_{th} = C_{th} + D_{th}, \tag{2.13}$$

where D_{th} is the expected across-analyst dispersion, i.e., $D_{th} \equiv E(d_{th})$ and C_{th} is the average covariance among forecast errors:

$$C_{th} = \frac{1}{N(N-1)} \sum_{i=1}^{N} \sum_{j \neq i}^{N} Cov(A_t - F_{ith}, A_t - F_{jth}). \tag{2.14}$$

Their result justifies forecast dispersion as one component of forecast uncertainty. Under our framework, we can simplify the expression for the average covariance among individual forecast errors in equation (2.14) as[7]

$$C_{th} = \frac{1}{N(N-1)} \sum_{i=1}^{N} \sum_{j \neq i}^{N} E[(\lambda_{th} + \varepsilon_{ith})(\lambda_{th} + \varepsilon_{jth})] = \sigma^2_{\lambda_{th}}, \tag{2.15}$$

which can be easily interpreted as the uncertainty shared by all forecasters due to their exposure to common unpredictable shocks. Thus, the added structure we impose leads to equation (2.15), which greatly simplifies the results in Barry and Jennings (1992) and BKLS.

2.4 Research Design

Based on the general model described above, BKLS provides a direct empirical estimate of analysts' overall uncertainty (V) and an estimate of the proportion of analysts' information that is common (ρ) using observable features of analysts' forecasts:

$$\rho_{it} = \frac{SE_{it} - \frac{D_{it}}{N}}{SE_{it} + (1 - \frac{1}{N})D_{it}}, \tag{2.16}$$

$$V_{it} = 1 \Big/ \left(SE_{it} + \left(1 - \frac{1}{N}\right) D_{it} \right), \tag{2.17}$$

[7]Note that $E(\varepsilon_{ith}\varepsilon_{jth}) = 0$ for any t, h and $i \neq j$ (Assumption 2) and $E(\varepsilon_{ith}\lambda_{t-k,j}) = 0$ for any i, t, h, k and j (Assumption 3).

where ρ is commonality in analysts' beliefs, measured as the expected covariance of error in individual forecasts; V is uncertainty in the information conveyed by analysts' forecasts, measured as the expected variance of error in individual forecasts; SE is the expected squared error of the mean forecast; D is expected forecast dispersion; and N is the number of analysts.

BKLS commonality measure can also be expressed as the ratio of the precision of analysts' common information to the precision of their total information ($\frac{h}{h+s}$), h and s are the precision of individual analysts' common and idiosyncratic information, respectively. As with estimation of ρ, estimation of h and s is based on observable features of analysts' forecasts:

$$h_{it} = \frac{SE_{it} - \frac{D_{it}}{N}}{\left[SE_{it} + (1 - \frac{1}{N})D_{it}\right]^2} \tag{2.18}$$

and

$$s_{it} = \frac{D_{it}}{\left[SE_{it} + (1 - \frac{1}{N})D_{it}\right]^2}. \tag{2.19}$$

BKLS suggests that one can use observed dispersion and mean squared error as proxies for D_{it} and SE_{it} to empirically estimate the constructs in equations (2.1) through (2.4). However, theoretically, these are *ex ante* constructs, attached to a forecast before the actual earnings are known and hence, they must be constructed using data available to analysts at the time forecasts are issued. Our model and proxies defined in Equations (2.16)–(2.18) suggest that the information environment is a function of dispersion and the variance of accumulated aggregate shocks. While the estimation of dispersion is straight-forward and is based on *ex ante* information, i.e., prior to the revelation of actual earnings, estimating the variance of aggregate shocks empirically poses a problem, because some periods are likely to be more volatile than others and volatile periods tend to cluster. To deal with these problems, Engle (1982) develops the celebrated Autoregressive Conditional Heteroskedasticity (ARCH) model, which is generalized by Bollerslev (1986) to form GARCH. These models can be used to estimate volatility conditional on historical data and are therefore suitable for our purpose. The method is now a standard approach for modeling different types of uncertainty in economics and finance (e.g., Batchelor and Dua, 1993; and Giordani and Söderlind, 2003) and has been introduced to accounting by Sheng and Thevenot (2012). In this setting, the GARCH model assumes that the variability of common forecast errors depends on past forecast errors and lagged earnings forecast uncertainty. The method uses the time-series of

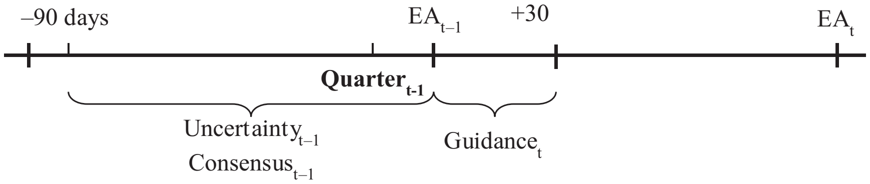

Figure 2.1: Timeline.

mean analyst forecast errors, in which any idiosyncratic errors are expected to be averaged out, to provide an estimate of the variance of common errors. We estimate a simple GARCH(1, 1) model and generate the conditional variance, $\hat{\sigma}^2_{\lambda_{th}}$, which is then used as an estimate of SE_{it} in the proxies above. This procedure provides a stable, reliable and comprehensive estimate of analyst information environment that can be used in settings where others cannot, such as when firms' operations are affected by significant unanticipated events like 9/11, bankruptcy and large restructuring charges and when the construct of interest is the change in information environment (Sheng and Thevenot, 2012).

We examine the association between pre-disclosure commonality and uncertainty among analysts and management decision to issue future earnings guidance. Since we are interested in how managers respond to their firms' information environment, we first discuss the timing of the variable measurement. As Figure 2.1 illustrates, we measure our variables of interest sequentially. The information environment variables are obtained using analyst forecasts of the current quarter's earnings issued in the 90 days prior to quarter $t-1$ earnings announcement and this window excludes the day of the announcement. Guidance is measured using management forecasts between the announcement of quarter $t-1$ earnings and the 30 days following, where the day of the announcement is included in this window as managers often bundle their forecasts with the earnings announcement.[8] Our goal is to ascertain the issuance of guidance is a response to the prior information in analyst forecasts. However, this is a limitation of our study design, as one could alternatively view that the issuance of guidance is partially a response to the earnings news. Our primary results, however, are not attributable to this aspect of our study design, because we obtain consistent results restricting our sample to guidance issued more than 5 days after quarter $t-1$ earnings announcement.

[8]The target period for guidance is not restricted but in a robustness check, we restrict guidance to be for quarter t only and find similar results.

To test our hypotheses we estimate the following regression model:

$$Guide_{it} = \beta_0 + \beta_1^* Uncert_{it-1} + \beta_2^* Comm_{it-1} + \beta_k^* X_{it-1}^k + e_{it}, \qquad (2.20)$$

where *Guide* equals 1 if a firm issues a forecast in the 30 days following the announcement of quarter $t-1$ earnings, and zero otherwise, *Uncert* and *Comm* are uncertainty and commonality, respectively, measured prior to the announcement of quarter $t-1$ earnings, and X^k represents a vector of k control variables including *PriorGuide*, *Prior8Guide*, *Assets*, *BM*, *FourthQ*, *Optimism*, *EPSVolat*, *Return*, *Loss*, *FSE*, *Following*, *Litigation*, *Restat* and *News*, which are defined below. The control variables are measured as of the end of quarter $t-1$.

We follow prior guidance research and control for other factors that may affect management's forecasting behavior. Extant studies show that guidance behavior is "sticky" and we include two variables intended to control for the firm's guidance history. *PriorGuide* is equal to one if the firm issued guidance in the previous quarter, and zero otherwise, and *Prior8Guide* is equal to the number of quarters from $t-8$ to $t-1$ during which the firm issued guidance. We include *Assets*, the amount of total assets as of the end of quarter $t-1$, because larger firms are more likely to issue guidance. *BM* is the firm's book value of equity divided by its market value of equity at the end of quarter $t-1$, controls for the effect of value vs. growth firms. *FourthQ* is an indicator variable equal to one if quarter $t-1$ is the fourth quarter because managers may be more responsive to unbeneficial information environment characteristics concerning the fourth quarter. We explicitly incorporate a control for analyst following (*Following*). *Following* is the number of analysts following the firm during quarter $t-1$ since firms with heavier analyst following are more likely to provide management guidance (Ajinkya, Bhojraj, and Sengupta, 2005). We also include controls for earnings volatility (*EPSVolat*), prior returns (*Return*), the presence of prior losses (*Loss*), the extent to which managers have failed to meet prior analysts' expectations (*FSE*), litigation risk (*Litigation*), and the incidence of restatement (*Restat*) (Brochet, Faurel, and McVay, 2011).[9] *EPSVolat* is equal to the standard deviation of quarterly earnings per share over quarters $t-8$ through $t-1$ and is included because firms with more volatile earnings are less likely to issue

[9]Brochet *et al.* (2011) also include an indicator variable for restructuring. We do not control for restructuring in our main analysis because restructuring data is available starting in 2001 and that decreases our sample. However, our results are robust to including an indicator variable for restructuring, where *Restruct* is equal to one if the firm reports restructuring charges in quarter $t-1$, and restricting our sample to the later years.

guidance (Waymire, 1985). *Return* is equal to the cumulative size-adjusted return over quarter $t-1$ and *Loss* is the percentage of quarters during which the firm reported negative earnings over quarters $t-8$ to $t-1$. These variables control for performance as Miller (2002) shows that firms with good performance are more likely to issue guidance. *FSE* is the percentage of quarters during which the firm failed to meet the consensus analyst forecast upon announcement of quarterly earnings over $t-4$ to $t-1$ and controls for the possibility that firms with historically disappointing results are less likely to issue guidance (Feng and Koch, 2010). *Litigation* is equal to one if the firm is operating within a high-litigation-risk industry, and zero otherwise. *Restat* is equal to one if the firm announces a restatement during quarters $t-1$ and t, and zero otherwise. *Litigation* and *Restat* are included to control for managers' incentives or disincentives to provide guidance when their firms are affected by such uncertain events. Finally, *News* is equal to the difference between the actual and the analyst consensus forecast of quarter t earnings issued in the 30 days following the earnings announcement of quarter $t-1$ earnings, where at least two analysts provide a forecast in this time period, scaled by the absolute value of actual earnings. We include this variable because managers often issue forecasts to preempt bad news to avoid legal repercussions (Skinner, 1994; and Kasznik and Lev, 1995).

Since many of our continuous variables are skewed with outlying observations, we use ranked variables. In each year, firm/quarters are assigned a decile rank based on the continuous variables, i.e., *Uncert*, *Comm*, *Prior8Guide*, *Assets*, *BM*, *EPSVolat*, *Return*, *FSE*, *Following* and *News*. The decile ranks are scaled to [0, 1] and used for the respective continuous independent variables in the regressions, where "R" at the end of a variable indicates the ranked variable.[10] In addition, we follow prior guidance research and include industry and year fixed effects, and cluster standard errors by firms.

2.5 Sample and Descriptive Statistics

2.5.1 *Sample*

Table 2.1 summarizes our sample selection procedure. Our initial sample includes all US firms with quarterly forecasts in the I/B/E/S Detail tape

[10]Our results are qualitatively similar if we use raw variables or the natural logarithm transformation of the variables that take only positive values, such as *Uncert, Comm, Prior8Guide, Assets, BM, EPSVolat, Loss, FSE* and *Following*.

Table 2.1: Sample selection.

	Firm/ Quarters	Firms
Sample with at least 40 consecutive quarters in period 1983–2010	36,919	636
Less firm/quarters prior to 1997	17,442	18
Initial sample	19,477	618
Less firm/quarters with unavailable data for control variables	4,054	51
Final sample	15,423	567
	Firm/ Quarters	**Percent**
Initial sample		
Firm/Quarters where Guide = 1	5,621	28.86
Firm/Quarters where Guide = 0	13,853	71.14
Final sample		
Firm/Quarters where Guide = 1	4,105	26.62
Firm/Quarters where Guide = 0	11,318	73.38

Notes: Our sample includes all US firms with quarterly forecasts in the I/B/E/S Detail tape for the period 1983–2010 with at least two analyst forecasts in the 90 days prior to the quarterly earnings announcement.

for the period 1983–2010. For the purposes of obtaining the measures of interest in this paper, we use analyst forecasts made 90 days prior to the quarterly earnings announcement where the earnings announcement is made within 90 days of the quarter end. If an analyst issues multiple forecasts in this period, we retain only the forecast closest to the earnings announcement date. In order to calculate our information environment variables, we require that there are at least two forecasts in each firm/quarter and a minimum of 40 consecutive quarters of observations in the 1983–2010 time period. This yields a total of 36,919 firm/quarter observations from 636 unique firms.

Further, we eliminate observations prior to 1997 as guidance data on the First Call Company Issued Guidelines file begins in 1995 and we need up to eight quarters prior to each firm/quarter to calculate controls for previous guidance. In addition, restatement data is available starting in 1997. We also eliminate observations where commonality is less than zero, which represent measurement errors. This leaves us with 19,319 firm/quarter observations in the period 1997–2010 from 618 unique firms, which constitute the sample used for our initial analysis of the relationships of dispersion with uncertainty and commonality. We further eliminate 4,054 observations from 51 firms with unavailable data for our control variables. Our final sample includes 15,423 firm/quarter observations from 567 unique firms, with managers issuing guidance in approximately 27% of the firm/quarters.

2.5.2 *Descriptive statistics*

The descriptive statistics pertaining to the variables used in our empirical analyses are presented in Table 2.2. Panel A displays results for the full sample and Panel B shows statistics by the presence of guidance and provides results of differences between means and medians of the sub samples. Panel A shows that our sample is comprised of large and heavily followed firms, which trade at a substantial premium over book value. Based on summary statistics for commonality, it appears that analysts following our sample firms rely more on common, rather than idiosyncratic information. Summary statistics for uncertainty, dispersion and information precision show large standard deviations and skewness, supporting the use of ranked, rather than raw variables.

Further, Panel B of Table 2.2 shows that dispersion, uncertainty, commonality and information precision in no guidance quarters are significantly higher than in guidance quarters. Firms that tend to guide less frequently are bigger, have higher book-to-market ratios and more volatile prior earnings, are more likely to report losses and miss analyst forecasts. On the other hand, guiders are more likely to face higher litigation risk or be involved in restatements. Overall, the evidence is generally consistent with prior research and our research design explicitly controls for the differences between guiding and non guiding firms.

Table 2.3 provides Pearson and Spearman correlation coefficients between the variables used in the regression analysis. Most correlation coefficients are significant at the 5% level. Uncertainty and commonality are positively correlated suggesting that when uncertainty is high, analysts likely rely more on common, rather than idiosyncratic information. Public and private information precisions are negatively related to both uncertainty and commonality indicating that analyst information tends to be imprecise when they are highly uncertain. Moreover, analysts tend to have higher commonality when they have imprecise information. Dispersion is strongly positively related to analysts' uncertainty but strongly negatively related to the commonality in analysts' information. These preliminary findings suggests that, if dispersion is included in a model with uncertainty and commonality excluded, while being correlated with the dependent variable, then the coefficient on dispersion will be biased. The direction of the bias, assuming no other variables are considered, will be driven by how uncertainty and commonality relate to

Table 2.2: Descriptive statistics.

Panel A: Full Sample (N = 15,423)

Variable	Mean	Std Dev	Q1	Median	Q3
Uncert	0.089	1.634	0.001	0.002	0.010
Comm	0.784	0.219	0.688	0.860	0.951
PublicPrec	1, 612.460	6, 062.890	70.812	296.604	1, 208.150
PrivatePrec	517.167	3,553.150	8.124	51.466	266.803
Disp	0.010	0.201	0.000	0.000	0.001
PriorGuide	0.305	0.460	0.000	0.000	1.000
Prior8Guide	2.411	3.032	0.000	1.000	5.000
Assets	42,214.630	153,984.850	2,576.750	7,700.320	24,639.000
BM	0.464	0.366	0.246	0.400	0.585
FourthQ	0.238	0.426	0.000	0.000	0.000
EPSVolat	0.511	0.789	0.145	0.270	0.556
Return	0.014	0.193	−0.092	0.001	0.101
Loss	0.103	0.184	0.000	0.000	0.125
FSE	0.259	0.267	0.000	0.250	0.500
Following	16.167	6.476	11.000	15.000	20.000
Litigation	0.176	0.381	0.000	0.000	0.000
Restat	0.011	0.106	0.000	0.000	0.000
News	−0.067	142.980	−0.044	0.021	0.110

(*Continued*)

Table 2.2: (*Continued*)

Panel B: Sample by Guidance

	Guide = 1 (N = 4,105)					Guide = 0 (N = 11,318)						
Variable	**Mean**	**Std Dev**	**Q1**	**Median**	**Q3**	**Mean**	**Std Dev**	**Q1**	**Median**	**Q3**	***t*-test**	**Wilcoxon rank sum test**
Uncert	0.024	0.160	0.001	0.002	0.005	0.113	1.905	0.001	0.003	0.012	0.003	<0.0001
Comm	0.771	0.223	0.668	0.848	0.944	0.789	0.217	0.697	0.865	0.953	<0.0001	<0.0001
PublicPrec	1,289.090	3,402.740	134.199	409.006	1,310.760	1,729.750	6,770.640	57.962	254.439	1,148.980	<0.0001	<0.0001
PrivatePrec	445.254	1,389.020	16.094	83.999	335.121	543.250	4,062.280	6.533	41.773	241.912	0.130	<0.0001
Disp	0.003	0.056	0.000	0.000	0.001	0.012	0.232	0.000	0.000	0.001	0.019	<0.0001
PriorGuide	0.770	0.421	1.000	1.000	1.000	0.137	0.343	0.000	0.000	0.000	<0.0001	<0.0001
Prior8Guide	6.337	2.283	5.000	8.000	8.000	0.987	1.737	0.000	0.000	1.000	<0.0001	<0.0001
Assets	30,640	82,478	3,225	9,878	27,288	46,413	172,566	2,405	7,076	23,607	<0.0001	<0.0001
BM	0.417	0.281	0.238	0.357	0.534	0.482	0.391	0.251	0.416	0.603	<0.0001	<0.0001
FourthQ	0.242	0.428	0.000	0.000	0.000	0.236	0.425	0.000	0.000	0.000	0.474	0.474
EPSVolat	0.414	0.557	0.136	0.236	0.472	0.547	0.855	0.149	0.282	0.592	<0.0001	<0.0001
Return	0.015	0.160	−0.076	0.005	0.096	0.013	0.203	−0.098	−0.001	0.103	0.716	0.022
Loss	0.082	0.168	0.000	0.000	0.125	0.111	0.189	0.000	0.000	0.125	<0.0001	<0.0001
FSE	0.174	0.218	0.000	0.000	0.250	0.290	0.276	0.000	0.250	0.500	<0.0001	<0.0001
Following	17.722	6.463	13.000	17.000	22.000	15.602	6.388	11.000	15.000	20.000	<0.0001	<0.0001
Litigation	0.271	0.445	0.000	0.000	1.000	0.141	0.348	0.000	0.000	0.000	<0.0001	<0.0001

(*Continued*)

Table 2.2: (*Continued*)

	Guide = 1 ($N = 4{,}105$)					Guide = 0 ($N = 11{,}318$)						
Variable	**Mean**	**Std Dev**	**Q1**	**Median**	**Q3**	**Mean**	**Std Dev**	**Q1**	**Median**	**Q3**	***t*-test**	**Wilcoxon rank sum test**
Restat	0.016	0.127	0.000	0.000	0.000	0.009	0.097	0.000	0.000	0.000	0.000	0.000
News	−0.034	5.098	−0.008	0.038	0.117	−0.079	166.881	−0.061	0.015	0.106	0.986	<0.0001

Notes: *Guide* is equal to one if the firm provides guidance in the 30 days following the earnings announcement, and zero otherwise. *Uncert* is equal to V per BKLS, as modified by Sheng and Thevenot (2012), calculated in the 90 days before the earnings announcement. *Comm* is equal to ρ per BKLS, as modified by Sheng and Thevenot (2012), calculated in the 90 days before the earnings announcement. *PublicPrec* is equal to h per BKLS, as modified by Sheng and Thevenot (2012), calculated in the 90 days before the earnings announcement. *PrivatePrec* is equal to s per BKLS, as modified by Sheng and Thevenot (2012), calculated in the 90 days before the earnings announcement. *Disp* is equal to the sample variance of analyst forecasts in the 90 days before the earnings announcement. *PriorGuide* is equal to one if the firm issued guidance in the previous quarter, and zero otherwise. *Prior8Guide* is equal to the number of quarters from $t-8$ to $t-1$ during which the firm issued guidance. *Assets* is the amount of total assets as of the end of quarter $t-1$. *BM* is the firm's book value of equity divided by its market value of equity at the end of quarter $t-1$. *FourthQ* is an indicator variable equal to one if quarter $t-1$ is the fourth quarter. *EPSVolat* is equal to the standard deviation of quarterly earnings per share over quarters $t-8$ through $t-1$. *Return* is equal to the cumulative size-adjusted return over quarter $t-1$. *Loss* is the percentage of quarters during which the firm reported negative earnings over quarters $t-8$ to $t-1$. *FSE* is the percentage of quarters during which the firm failed to meet the consensus analyst forecast upon announcement of quarterly earnings over $t-4$ to $t-1$. *Following* is the number of analysts following the firm during quarter $t-1$ since firms with heavier analyst following are more likely to provide management guidance. *Litigation* is equal to one if the firm is a member of one of the following high-litigation-risk industries: SIC codes 2833–2836 (biotechnology), 3570–3577 and 7370–7374 (computers), 3600–3674 (electronics), 5200–5961 (retailing), and 8731–8734 (R&D service), and suffers a 20% or greater decrease in earnings; and zero otherwise. *Restat* is equal to one if the firm announces a restatement during quarters $t-1$ and t, and zero otherwise. *News* is equal to the difference between the actual and the analyst consensus forecast of quarter t earnings issued in the 30 days following the earnings announcement of quarter $t-1$ earnings, where at least two analysts provide a forecast in this time period, scaled by the absolute value of actual earnings.

Table 2.3: Pearson (above the Diagonal) and Spearman (below the Diagonal) correlation coefficients.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**	**(14)**	**(15)**	**(16)**	**(17)**	**(18)**	**(19)**
Guide (1)	1	**−0.17**	**0.03**	**0.17**	**0.11**	**−0.17**	**0.61**	**0.57**	0.01	**−0.14**	0.01	**−0.05**	0.01	**−0.07**	**−0.15**	**0.06**	**0.15**	**0.03**	**0.05**
UncertR (2)	**−0.17**	1	**0.21**	**−0.97**	**−0.83**	**0.75**	**−0.11**	**−0.18**	**0.18**	**0.51**	0.00	**0.46**	**−0.06**	**0.24**	**0.24**	**−0.23**	**−0.14**	**0.02**	**−0.04**
CommR (3)	**0.03**	**0.21**	1	**−0.07**	**−0.65**	**−0.40**	−0.01	**−0.03**	**0.04**	**0.07**	**−0.03**	**0.03**	**0.06**	0.00	**−0.05**	**−0.10**	**−0.03**	0.00	**0.03**
PublicPrecR (4)	**0.17**	**−0.97**	**−0.06**	1		**−0.82**	**0.10**	**0.17**	**−0.17**	**−0.50**	0.00	**−0.44**	**0.08**	**−0.23**	**−0.24**	**0.21**	**0.13**	**−0.02**	**0.04**
PrivatePrecR (5)	**0.11**	**−0.83**	**−0.64**		1	**−0.34**	**0.08**	**0.14**	**−0.14**	**−0.42**	0.01	**−0.36**	**0.02**	**−0.19**	**−0.15**	**0.23**	**0.12**	**−0.02**	**0.02**
DispR (6)	**−0.17**	**0.75**	**−0.40**	**−0.82**	**−0.34**	1	**−0.10**	**−0.14**	**0.15**	**0.42**	**0.02**	**0.41**	**−0.09**	**0.21**	**0.25**	**−0.12**	**−0.10**	**0.02**	**−0.05**
PriorGuide (7)	**0.61**	**−0.11**	−0.01	**0.10**	**0.08**	**−0.10**	1	**0.63**	−0.01	**−0.09**	0.00	**−0.03**	**−0.03**	**−0.05**	**−0.09**	0.01	**0.10**	**0.02**	0.02
Prior8GuideR (8)	**0.55**	**−0.17**	**−0.03**	**0.16**	**0.14**	**−0.14**	**0.61**	1	0.00	**−0.13**	**0.02**	**−0.03**	−0.01	**−0.04**	**−0.12**	**0.09**	**0.18**	0.02	**0.04**
AssetsR (9)	0.01	**0.18**	**0.04**	**−0.17**	**−0.14**	**0.15**	−0.01	0.00	1	**0.10**	0.01	**0.09**	**−0.02**	**−0.12**	0.00	**0.27**	**−0.18**	0.01	**−0.06**
BMR (10)	**−0.14**	**0.52**	**0.07**	**−0.50**	**−0.42**	**0.41**	**−0.09**	**−0.12**	**0.10**	1	**0.02**	**0.28**	**−0.19**	**0.20**	**0.25**	**−0.26**	**−0.08**	**0.02**	**−0.06**
Fourth (11)	0.01	0.00	**−0.03**	0.00	0.01	**0.02**	0.00	**0.02**	0.01	**0.02**	1	0.00	**−0.02**	0.00	−0.01	**0.03**	**−0.04**	−0.01	**−0.04**
EPSVolatR (12)	**−0.05**	**0.46**	**0.03**	**−0.44**	**−0.36**	**0.41**	**−0.03**	**−0.02**	**0.09**	**0.28**	0.00	1	−0.01	**0.40**	**0.10**	**−0.16**	**0.04**	**0.03**	**0.04**
ReturnR (13)	0.01	**−0.06**	**0.06**	**0.07**	**0.02**	**−0.09**	**−0.03**	−0.01	**−0.02**	**−0.19**	**−0.02**	−0.01	1	**−0.03**	**−0.10**	0.00	**−0.03**	−0.01	**0.13**
Loss (14)	**−0.08**	**0.26**	−0.01	**−0.22**	**−0.18**	**0.23**	**−0.05**	**−0.03**	**−0.10**	**0.22**	0.00	**0.51**	**−0.03**	1	**0.14**	**−0.10**	**0.19**	**0.04**	**0.07**
FSER (15)	**−0.15**	**0.24**	**−0.05**	**−0.24**	**−0.16**	**0.24**	**−0.09**	**−0.12**	0.00	**0.25**	−0.01	**0.10**	**−0.10**	**0.14**	1	**−0.13**	**−0.06**	0.01	**−0.15**
FollowingR (16)	**0.05**	**−0.23**	**−0.10**	**0.21**	**0.23**	**−0.11**	0.01	**0.08**	**0.27**	**−0.26**	**0.03**	**−0.16**	0.00	**−0.11**	**−0.13**	1	**0.16**	0.01	0.02
Litigation (17)	**0.15**	**−0.14**	**−0.03**	**0.13**	**0.12**	**−0.10**	**0.10**	**0.18**	**−0.18**	**−0.08**	**−0.04**	**0.04**	**−0.03**	**0.15**	**−0.06**	**0.16**	1	**0.03**	**0.03**
Restat (18)	**0.03**	**0.02**	0.00	**−0.02**	**−0.02**	**0.02**	**0.02**	0.01	0.01	**0.02**	−0.01	**0.03**	−0.01	**0.04**	0.01	0.01	**0.03**	1	−0.01
NewsR (19)	**0.05**	**−0.04**	**0.03**	**0.04**	**0.02**	**−0.05**	0.02	**0.04**	**−0.06**	**−0.06**	**−0.04**	**0.04**	**0.13**	**0.06**	**−0.15**	**0.02**	**0.03**	−0.01	1

Notes: The variables are defined in Table 2.2 and "R" at the end of the variable name represents the decile rank scaled to vary between zero and one of the respective variable. Correlation coefficients that are significant at the 0.05 level or better are presented in bold.

the dependent variable. If uncertainty is positively related to the dependent variable but commonality is negatively related, then dispersion's coefficient will be positively biased, as it will capture both effects simultaneously. If both uncertainty and commonality are positively related to the dependent variable, then the coefficient will be negatively biased, smaller and even statistically insignificant, as dispersion will capture the net effect of uncertainty and commonality. In subsequent analyses, we show how the use of dispersion in our setting can lead to biased results or incorrect inferences, if it is taken to serve as a proxy for analysts' prior information.

2.6 Empirical Results

2.6.1 *The decision to forecast*

We present our main logistic regression results in Table 2.4. In Panel A, the columns on the left (right) show the relation of guidance with commonality and uncertainty (the precision of common and private information). Our models are well specified with pseudo R-squares approximating 60 percent.

As expected with the control variables, the coefficients on both prior guidance measures are positive and significant, consistent with guidance being "sticky". The negative coefficients on both *Loss* and *FESR* suggest firms that performed poorly and fell short of analysts' expectations in the past are less likely to provide guidance (Miller, 2002; and Feng and Koch, 2010). Also consistent with expectation, the coefficient on *BMR* is negative and significant. The coefficient on *NewsR* is positive and significant.[11]

Furthermore, the columns on the left show that guidance is positively related to commonality (*CommR*) with a coefficient of 0.567, while guidance and uncertainty (*UncertR*) are negatively related with a coefficient of −0.477. Our theoretical framework suggests that managers prefer to issue guidance when analysts' incentives to develop private information is high and their private information is more precise. The positive association between analysts' information commonality and earnings guidance is consistent with our theoretical prediction. This suggests that, when commonality is high, analysts have greater incentives to develop private information from public disclosures and managers have incentives to fit the specific needs of analysts. We confirm our inferences by separately examining the precision of common and private information. The columns on the right show that managers are

[11]This may imply that managers are more likely to quickly disclose good news compared to bad news in the hope that their negative news will be reversed later in the quarter (e.g., Graham *et al.*, 2005).

Table 2.4: Analysis of management guidance as a response to analysts' incentives to develop private information.

Panel A: Using the Modified BKLS Proxies

	Dependent variable = Guide			
Variable	**Coefficient**	**Marginal effect**	**Coefficient**	**Marginal effect**
Intercept	-2.970^{***}	—	-3.403^{***}	—
	(76.24)	—	(30.21)	—
UncertR	-0.477^{**}	−0.030	0.254	0.016
	(4.93)	—	(0.18)	—
CommR	0.567^{***}	0.036	—	—
	(19.07)	—	—	—
PublicPrecR	—	—	1.006^{**}	0.064
	—	—	(4.44)	—
PrivatePrecR	—	—	-0.467^{*}	−0.030
	—	—	(3.75)	—
Priorguide	0.967^{***}	0.061	0.975^{***}	0.062
	(95.74)	—	(97.81)	—
Prior8GuideR	5.558^{***}	0.352	5.557^{***}	0.352
	(505.21)	—	(505.30)	—
AssetsR	0.106	0.007	0.095	0.006
	(0.15)	—	(0.12)	—
BMR	-0.495^{**}	−0.031	-0.497^{**}	−0.031
	(5.51)	—	(5.50)	—
fourthQ	0.028	0.002	0.019	0.001
	(0.20)	—	(0.10)	—
EPSVolatR	0.290	0.018	0.278	0.018
	(2.26)	—	(2.06)	—
ReturnR	−0.072	−0.005	−0.069	−0.004
	(0.51)	—	(0.47)	—
Loss	-1.062^{***}	−0.067	-1.084^{***}	−0.069
	(9.14)	—	(9.46)	—
FSER	-0.564^{***}	−0.036	-0.576^{***}	−0.036
	(19.77)	—	(20.63)	—
FollowingR	0.151	0.010	0.142	0.009
	(0.56)	—	(0.49)	—
Litigation	0.134	0.008	0.134	0.008
	(1.17)	—	(1.16)	—
Restat	0.104	0.007	0.102	0.006
	(0.12)	—	(0.12)	—
NewsR	0.254^{**}	0.016	0.262^{**}	0.017
	(6.21)	—	(6.63)	—
Industry fixed effects	Yes	—	Yes	—
Year fixed effects	Yes	—	Yes	—
Firm clustered errors	Yes	—	Yes	—
Guide 30 days after = 0	11,318	—	11,318	—
Guide 30 days after = 1	4,105	—	4,105	—
Pseudo R-Square	0.60	—	0.60	—

(*Continued*)

Table 2.4: (*Continued*)

Panel B: Using Forecast Dispersion

Dependent variable = Guide		
Variable	**Coefficient**	**Marginal effect**
Intercept	-2.751^{***}	—
	(66.79)	—
DispR	-0.739^{***}	−0.047
	(23.87)	—
Priorguide	0.973^{***}	0.062
	(98.73)	—
Prior8GuideR	5.538^{***}	0.354
	(509.90)	—
AssetsR	0.124	0.008
	(0.20)	—
BMR	-0.432^{**}	−0.028
	(4.41)	—
FourthQ	0.031	0.002
	(0.26)	—
EPSVolatR	0.380^{**}	0.024
	(4.06)	—
ReturnR	−0.067	−0.004
	(0.45)	—
Loss	-1.084^{***}	−0.069
	(9.66)	—
FSER	-0.553^{***}	−0.035
	(19.44)	—
FollowingR	0.141	0.009
	(0.49)	—
Litigation	0.137	0.009
	(1.20)	—
Restat	0.099	0.006
	(0.11)	—
NewsR	0.278^{***}	0.018
	(7.62)	—
Guide 30 days after = 0	11,398	—
Guide 30 days after = 1	4,140	—
Pseudo R-Square	0.60	—

Notes: All variables are defined in Tables 2.2 and 2.3. We include industry and year fixed effects and report firm-clustered standard errors. Chi-square statistics are presented in parentheses below the coefficients.
***, ** indicate significance at the 1 and 5 percent level, respectively.

more likely to issue forecasts when the precision of analysts' common information is high but the precision of their idiosyncratic information is low, suggesting guidance is prompted by the relative presence of common information, as captured by the commonality among analysts. In contrast, the result of the inverse relationship between analysts' uncertainty and earnings guidance is inconsistent with the interpretation that managers increase disclosure to supply the information that analysts need to resolve uncertainty. Rather, the result is consistent with the possibility that the high uncertainty of analysts corresponds with that of managers, and managers refrain from issuing forecasts when faced with information of low precision.

Panel B presents results using forecast dispersion as a proxy for analysts' pre-disclosure information. Results show that dispersion is negatively related to guidance, with a coefficient estimate of −0.739 (Chi-square statistic = 23.87). The magnitude of the coefficient is greater than those for either commonality or uncertainty as reported in Panel A. This is consistent with dispersion capturing the effects of both uncertainty and lack of commonality, when they are related to the variable of interest, guidance, in the opposite direction. If dispersion is taken as a proxy for either factor in this situation, the respective effect on guidance could be overstated.

Overall, our findings show that management guidance increases only with the commonality contained in analysts' pre-disclosure information, but not with levels of uncertainty. The inverse relation between uncertainty and guidance is consistent with the theoretical framework, which models disclosure as a function of analysts' private information incentives and management's information precision. Our results suggest that the presence of a correlated factor (i.e., managers' information precision) might make it difficult to directly infer how analysts' uncertainty (as a proxy for their incentives to develop new information) affects managers' disclosure decisions. The commonality of information among analysts acts as a more reliable forecast antecedent as it captures solely analysts' private information incentives.

2.6.2 *Posterior market belief revisions*

We maintain that, as analysts' incentives to impound idiosyncratic information in their forecasts increase, analysts are more likely to revise their forecasts pursuant to management earnings forecasts. Barron *et al.* (2002) show that the average amount of new idiosyncratic information contained in individual analysts' forecasts increases as more analysts revise their forecasts. Furthermore, analysts' idiosyncratic interpretations of the disclosure lead to more informed trading, to the extent that investor demand for analyst reports increases with the level of a firm's disclosure (Bamber *et al.*, 1999). To verify these arguments, we further test the association of analysts' forecast revisions and trading volume with analysts' prior information.

Panel A of Table 2.5 presents summary statistics for the proportion of analysts who revise their forecasts in the 5 days following earnings announcements and management forecasts. Evidence suggests that the majority of

Table 2.5: Analysis of analysts' incentives to develop private information.

Panel A: Fraction of Analysts Who Revise and Trading Volume after Earnings Announcements and Management Guidance

	After EA			After guidance		
	N	**Mean**	**Median**	**N**	**Mean**	**Median**
Fraction of revising analysts	19,477	0.65	0.70	6,120	0.69	0.76
Trading volume	18,303	0.08	0.05	5,796	0.09	0.06
If guidance occurs more than 5 days after the EA						
Fraction of revising analysts	1,518	0.62	0.65	1,518	0.49	0.51
Trading volume	1,427	0.07	0.05	1,426	0.09	0.05

Panel B: Determinants of Analysts' Forecast Revisions and Trading Volume Following Guidance

Dependent variable	**Frac**	**Volume**
Intercept	0.177*	−0.015
	(1.813)	(−0.350)
CommR	0.019**	0.020***
	(2.252)	(5.085)
UncertR	0.037***	0.047***
	(3.255)	(8.875)
FourthQ	−0.013**	0.001**
	(−2.298)	(0.424)
FollowingR	0.055***	−0.014***
	(5.090)	(−2.850)
Losscurrent	0.011	0.018***
	(0.862)	(3.101)
NewsR	−0.024***	−0.016***
	(−2.806)	(−3.965)
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	5,621	5,405
R-squared	0.30	0.20

Table 2.5: (*Continued*)

Panel C: Using Forecast Dispersion as a Proxy for Analysts' Incentives for Developing Private Information

Dependent variable	**Frac**	**Volume**
Intercept	0.209**	0.030
	(2.14)	(0.67)
DispR	0.012	0.008*
	(1.29)	(1.83)
FourthQ	−0.014**	0.001
	(−2.45)	(0.40)
FollowingR	0.045***	−0.025***
	(4.31)	(−5.18)
Losscurrent	0.012	0.024***
	(0.96)	(3.97)
NewsR	−0.022***	−0.013***
	(−2.60)	(−3.36)
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	5,674	5,453
R-squared	0.296	0.177

Notes: Panel A presents the mean and median proportion of analysts out of all analysts following the firm in a given quarter who revise their forecast and trading volume scaled by average shares outstanding in the 5 days following the earnings announcement (AfterEA) and guidance (AfterGuide). In Panel B and Panel C, *Frac* is equal to the proportion of analysts out of all analysts following the firm who revise their forecast in the 5 days following guidance. *Volume* is the total trading volume scaled by average shares outstanding in the 5 days following guidance. *Losscurrent* is equal to one if the mean analyst forecast in the 30 days following the earnings announcement is negative, and zero otherwise. All other variables are defined in Tables 2.2 and 2.3. Models include industry and year fixed effects. T-statistics are presented in parentheses below the coefficients.

***, **, * indicate significance at the 1, 5 and 10% level, respectively.

analysts revise their forecasts to reflect the arrival of new information. The mean (median) fraction of revising analysts is 69 (76)% following guidance and 65 (70)% following earnings announcements. Even in the cases where guidance does not occur conjointly with an earnings announcement, the mean (median) proportion of revising analysts is 49 (51)%. The high frequency of posterior forecast revisions is consistent with managers using guidance to aid analysts in their role in developing new private information.

Panel B reports results from regressions of analysts' and investors' reactions to management earnings forecasts, as inferred from the fraction of analysts revising their forecasts (*Frac*) and trading volume (*Volume*) following guidance. For both *Frac* and *Volume*, the coefficient on commonality is positive and statistically significant (p-values <0.05), suggesting that, when the degree of commonality in their pre-disclosure forecasts is high, a greater fraction of analysts issue a new posterior forecast, and trading volume significantly increases. This finding suggests that analysts develop their own private information from public disclosures due to their preference for unique, idiosyncratic information (i.e., low commonality), and this, in turn, stimulates investors' differential interpretations of information. Furthermore, uncertainty is also positively related to the fraction of revising analysts and trading volume, implying that uncertainty also triggers analysts' and investors' belief revisions subsequent to management earnings forecasts. Combined, our findings are consistent with public announcements creating idiosyncratic beliefs because market participants possess different prior beliefs (see Barron *et al.*, 2002). Our results confirm our conjecture that analysts' and investors' reactions to management forecasts are conditioned on the nature of their prior information.

In Panel C, we use forecast dispersion as an alternative proxy for analysts' prior information. For both models, dispersion is statistically insignificant, which is again consistent with it capturing both uncertainty and commonality in analysts' information. Nonetheless, in this setting, the bias moves towards the null, because uncertainty and commonality affect the dependent variable in the same direction, while dispersion is positively related to uncertainty but negatively related to commonality.

Overall, our findings suggest that both commonality and uncertainty reflect market participants' incentives to develop private information, and are associated with more analyst effort, the generation of new idiosyncratic information, and greater trading activities following managers' decision to forecast. Dispersion fails to represent analysts' incentives, leading to erroneous inferences of no variation in market reactions conditional on analysts' prior information. Combined, the findings in Tables 2.4 and 2.5 provide evidence to support the notion that managers have incentives to issue earnings guidance to fit what analysts want.

2.6.3 *Management uncertainty as a correlated variable*

Next, we provide evidence on whether the inverse relation between management forecasts and analysts' uncertainty corresponds with a low r, i.e., low precision of management information. We first examine whether managers' and analysts' uncertainty is correlated. Prior research suggests that the form of a forecast captures the precision of managers' beliefs about the future (i.e., their uncertainty), and point forecasts are perceived to reflect greater managerial certainty relative to range forecasts (King *et al.*, 1990; Hughes and Pae, 2004). We code the type of guidance (*GuideP*) as one for descriptive forecasts, two for open-ended forecasts, three for range forecasts, and four for point forecasts, whereas a missing value for non guidance. We expect managers to reveal their uncertainty via issuing less precise guidance.

Table 2.6, Panel A provides the mean and median analyst uncertainty and dispersion (raw and ranked variables) based on the type of guidance. The last two columns present *p*-values for testing differences in the means/medians between different guidance types: descriptive vs. point, and open-ended vs. point. Across all tests, the difference in analysts' uncertainty between open-ended and point earnings guidance is highly statistically significant, suggesting that managers of firms with lower uncertainty in analyst forecasts are more likely to issue a more precise management forecast. Comparing descriptive and point forecasts provides similar, albeit weaker, results, although descriptive forecasts are somewhat different from numeric forecasts and hence may not be directly compared with other management forecasts. Panel B further presents Pearson and Spearman correlation coefficients between guidance precision and analysts' uncertainty. *GuideP* and its logarithm transformation *LGuideP* are always negatively and statistically significantly correlated with uncertainty. These findings provide evidence that analyst and managerial uncertainty are positively correlated, suggesting the possibility that the inverse relation between uncertainty and guidance reflects the low precision of management information.

2.6.4 *Cross-sectional analyses of the relation of guidance with commonality and uncertainty*

We next explore cross-sectional variations to corroborate our conjectures on the relation of guidance with commonality and uncertainty. First, it is possible that the inverse relation between uncertainty and guidance reflects the low precision of management information (i.e., a lower r). However, managers' responsiveness to uncertainty likely depends on their ability to identify changes in their firms' underlying economics. Trueman (1986) and Verrecchia (1990) suggest that executives may abstain from disclosure due to lack of confidence in their ability to predict future changes or concerns about the adverse effects of inaccuracies such as increased litigation risk and market volatility. Moreover, Baik *et al.* (2011) find evidence suggesting that high-ability managers are more likely to signal their ability to anticipate future firm prospects. We may therefore expect that the inverse relation between

Table 2.6: Analysis of relation between analyst uncertainty and manager uncertainty.

Panel A: Mean and Median Uncertainty and Dispersion by Guidance Precision

Variable	GuideP = . Mean	GuideP = 1 Mean	GuideP = 2 Mean	GuideP = 3 Mean	GuideP = 4 Mean	*T*-test difference GuideP = 1 vs. GuideP = 4	*T*-test difference GuideP = 2 vs. GuideP = 4
Uncert	0.118	0.137	0.104	0.029	0.017	<0.0001	0.011
UncertR	0.530	0.484	0.536	0.394	0.421	0.035	<0.0001

Variable	GuideP = . Median	GuideP = 1 Median	GuideP = 2 Median	GuideP = 3 Median	GuideP = 4 Median	Wilcoxon test difference GuideP = 1 vs. GuideP = 4	Wilcoxon test difference GuideP = 2 vs. GuideP = 4
Uncert	0.004	0.001	0.004	0.002	0.001	0.892	<0.0001
UncertR	0.556	0.444	0.556	0.333	0.333	0.064	<0.0001

Panel B: Pearson (Above the Diagonal) and Spearman (Below the Diagonal) Correlation Coefficients

	GuideP	LGuideP	Uncert	UncertR
GuideP	1	0.965	−0.059	−0.053
	—	<0.0001	<0.0001	0.000
LGuideP	1.000	1	−0.063	−0.064
	<0.0001	—	<0.0001	<0.0001
Uncert	−0.048	−0.048	1	0.096
	0.001	0.001	—	<0.0001
UncertR	−0.041	−0.041	0.970	1
	0.005	0.005	<0.0001	—

Notes: *GuideP* is equal to 4 if management provides a point forecast, equal to 3 if a range forecast, equal to 2 if an open-ended forecast, equal to 1 if descriptive. The value is set to be missing (".") if there is no guidance. *LGuideP* is the logarithm transformation of *GuideP*. All other variables are defined in Tables 2.2 and 2.3. Panel A presents the mean and median values of the given variables by *GuideP*. P-values of tests for differences in means and medians between *GuideP* equal to 4 and *GuideP* equal to 1 and between *GuideP* equal to 4 and *GuideP* equal to 2 are presented in the last two columns. Panel B presents Pearson and Spearman correlation coefficients among given variables. P-values of significance are presented below the correlation coefficients.

guidance and uncertainty is more (less) pronounced when managers are less (better) able to forecast the future.

Second, prior research suggests that frequent guiders likely have different forecasting abilities and motivations for issuing guidance than sporadic guiders. Firms issuing regular guidance commit more resources to making forecasts and issue more accurate guidance as they learn from experience (Bhojraj *et al.*, 2010). More frequent and more precise guidance also helps investors better incorporate future earnings into price (Choi *et al.*, 2011). Therefore, the inverse relation between guidance and uncertainty could be more pronounced if the forecast is sporadic rather than routine, possibly because frequent guiders can better cope with information uncertainty.

Finally, the inverse relation between guidance and uncertainty could be more (less) pronounced if the news is bad, because negative news may create greater uncertainty prior to the release of information. On the other hand, we expect managerial ability, forecast frequency, and news content to have little impact on the relation between guidance and commonality, which is a direct measure of analysts' need to develop unique information irrelevant to managers' information precision.

We present cross-sectional evidence on the relation of guidance with commonality and uncertainty in Table 2.7. Panel A separates the full sample based on manager-specific ability. Demerjian *et al.*, (2012) use data envelope analysis to create a score of manager-specific ability (MA-Score). We partition the sample into more (less) able manager subsamples based on a MA-Score above (below) the median. We show that the inverse relation between guidance and uncertainty is attributable to less able managers and guidance increases with commonality regardless. This finding is consistent with the interpretation that management forecast is a function of managers' own information uncertainty and their skill in anticipating future changes in firms' fundamentals.

Panel B separates the full sample into the regular and sporadic subsamples. Following Brochet *et al.* (2011), we define frequent guiders as firms providing guidance in at least four of the last eight quarters and infrequent guiders are those that provide guidance in at least one of the last eight quarters but are not a frequent guider. We find that uncertainty is negatively related to guidance for the infrequent guiders only, while commonality is positively related to guidance for both frequent and infrequent guiders. This suggests that high uncertainty is not a deterrent to guidance for firms that provide guidance more frequently, consistent with the prediction that this group of firms can better cope with information uncertainty.

Panel C separates the forecasts based on the sign of the news (*News*). Consistent with our prediction that uncertainty is higher in the bad news scenario, we show that the inverse relation between guidance and uncertainty tends to be attributable to forecasts that convey bad news,

Table 2.7: Cross-sectional analysis of the association between management guidance and analysts' incentives to develop private information.

Panel A: More vs. Less able managers

More able managers		**Less able managers**	
UncertR	−0.162	UncertR	−0.633**
	(0.15)		(5.82)
ConsR	0.624***	ConsR	0.624***
	(7.75)		(20.13)
Guide 30 days after = 0	3,751		7,567
Guide 30 days after = 1	1,483		2,622

Panel B: Frequent vs. Sporadic guiders

Frequent guiders		**Sporadic guiders**	
UncertR	−0.006	UncertR	−0.570*
	(0.00)		(3.29)
ConsR	0.670***	ConsR	0.381**
	(14.56)		(4.03)
Guide 30 days after = 0	882		3,474
Guide 30 days after = 1	3,438		573

Panel C: Good vs. Bad news

Good news		**Bad news**	
UncertR	−0.154	UncertR	−0.958***
	(0.41)		(10.10)
ConsR	0.503***	ConsR	0.729***
	(9.66)		(17.09)
Guide 30 days after = 0	6,605		4,552
Guide 30 days after = 1	2,880		1,193

Notes: More vs. less able managers is defined based on the median score of manager-specific ability (MA-Score) as developed in Demerjian *et al.* (2012). Frequent vs. sporadic guiders are defined based on whether firms provide guidance in at least 4 of the last 8 quarters and infrequent guiders are those that provide guidance in at least 1 of the last 8 quarters but are not a frequent guider. Good vs. bad news is based on the direction of *News* as previously defined in Table 2.2.

while commonality increases the probability of guidance when managers have either good or bad news.[12]

Overall, our findings suggest that the inverse relation between uncertainty and guidance is sensitive and limited to a small subset of firms with less able managers, infrequent forecasts, and bad news. Our results reinforce the possibility that management information precision is a correlated omitted variable in testing the effect of analysts' information uncertainty on guidance, making it difficult to infer how managers issue forecasts based on the nature of the information analysts possess. In contrast, the relation between commonality and guidance is robust, providing further support that commonality is a more reliable proxy for analysts' incentives to develop private information.

2.6.5 *Propensity-score matched samples*

Our analyses of the relation between management forecasts and analysts' prior information might suffer from an overt bias. That is, there may be some other systematic differences which are correlated with analysts' information commonality and uncertainty which may impact guidance firms' decisions to issue forecasts. To alleviate these concerns, we further adopt an alternative approach that is more robust to misspecification of the functional form of the underlying relationship between guidance and the commonality/uncertainty among analysts. Specifically, we use a propensity score matched-pair research design to match firms with similar disclosure environments but differing degrees of commonality and uncertainty among analysts. The propensity score procedure allows us to efficiently match along multiple dimensions and is more robust to a partial-matched econometric method using a small set of variables such as firm size and industrial classification (e.g., Armstrong *et al.*, 2010; and Lawrence *et al.*, 2011).

First, we estimate an ordered logistic propensity-score model, which is the probability that a firm observes a high level (i.e., higher quintiles) of commonality/uncertainty in analysts' information environment (i.e., the treatment) conditional on observable features of the disclosure environment

[12]We also run our main regression for the subsamples with small and large magnitude of news, as uncertainty also accompanies with larger news (results are untabulated). We deem a firm to have small news if the absolute value of *News* is below the median and large news if it is above the median. The link between management forecasts and analysts' commonality and uncertainty seems to be driven primarily by firms with larger gap in management and analyst expectations (i.e., when news is large); for firms with small news, uncertainty is insignificant but commonality remains to be positively related to guidance (*albeit* weaker).

(i.e., all control variables in our disclosure analyses, including year and industry fixed effects, as specified in equation (2.1)).[13] Following Armstrong *et al.* (2010), we identify matched-pairs, without replacement, by simultaneously minimizing the differences between propensity scores and maximizing the difference between commonality/uncertainty levels. Table 2.8, Panel A, presents the distribution of matched pairs based on the pairwise levels of commonality/uncertainty in analysts' information environment. The columns show the quintiles of the treatment (high commonality/uncertainty) groups in each matched pair, while the rows show the quintiles of the control (low commonality/uncertainty) groups. Not surprisingly, the highest quintiles of commonality/uncertainty (Quintile 5) have more permutations and the lowest quintiles have none.

Table 2.8: The relationship between analysts' commonality/uncertainty and management guidance: A propensity-score matched pair research design.

Panel A: Matched-Pair Frequencies for Commonality and Uncertainty Quintiles

Control commonality quintile	**Treatment commonality quintile**					
	1	**2**	**3**	**4**	**5**	**Total**
1	0	839	792	625	566	2,822
2		0	804	825	698	2,327
3			0	794	734	1,528
4				0	660	660
5					0	0
Total		839	1,596	2,244	2,658	7,337

Control uncertainty quintile	**Treatment uncertainty quintile**					
	1	**2**	**3**	**4**	**5**	**Total**
1	0	1,197	528	336	159	2,220
2		0	1,012	567	328	1,907
3			0	1,092	626	1,718
4				0	1,103	1,103
5					0	0
Total		1,197	1,540	1,995	2,216	6,948

[13]Matching models do not rely on a specific functional form to provide an indirect estimate of the treatment effects (Li and Prabhala, 2007). Instead, matching models require the inclusion of a comprehensive list of dimensions when estimating the propensity score.

Table 2.8: (*Continued*)

Panel B: Mean Guidance for the Treatment (High Commonality/Uncertainty) and the Control (Low Commonality/Uncertainty) Groups

Quintile for high commonality	Quintile for low commonality	# of pairs	Mean guide for treatment	Mean guide for control	t-stat difference treatment vs. control
5	4	660	0.264	0.232	1.339
5	3	734	0.285	0.243	1.837
5	2	698	0.278	0.261	0.724
5	1	566	0.311	0.214	3.735
4	3	794	0.312	0.283	1.262
4	2	825	0.293	0.244	2.280
4	1	625	0.267	0.272	−0.191
3	2	804	0.279	0.252	1.186
3	1	792	0.269	0.293	−1.062
2	1	839	0.247	0.244	0.113
Pooled	Pooled	7,337	0.449	0.436	3.433
5	4	1,103	0.131	0.184	−3.458
5	3	626	0.155	0.225	−3.179
5	2	328	0.183	0.204	−0.691
5	1	159	0.195	0.170	0.579
4	3	1,092	0.237	0.277	−2.155
4	2	567	0.242	0.259	−0.685
4	1	336	0.310	0.259	1.454
3	2	1,012	0.312	0.261	2.559
3	1	528	0.290	0.299	−0.337
2	1	1,197	0.362	0.381	−0.973
Pooled	Pooled	6,948	0.250	0.267	−2.307

Notes: Higher analysts' commonality/uncertainty observations are labeled as treatment, and lower commonality/uncertainty observations are labeled as control. Panel A presents the distribution of matched pairs according to their pairwise analysts' commonality/uncertainty quintiles. Panel B presents results regarding the relations of management guidance with analysts' commonality/uncertainty by testing differences in the frequency of guidance between the treatment and control groups.

Next, we further verify covariate balances between the 7,337 and 6,948 matched pairs of high/low commonality and uncertainty groups, respectively (untabulated). We find that the matching algorithm was successful in achieving balances, as the firms are similar in all respects. In Panel B, we examine the differences in the percentage of management guidance between the treatment and control samples. For the pooled propensity-matched sample, our results continue to suggest that higher analysts' information commonality levels are associated with a greater likelihood of management forecast issuance (t-stat. = 3.43), whereas higher analysts' uncertainty levels are associated with a lower likelihood of management forecast issuance (t-stat. = −2.31). Across each possible paring of commonality/uncertainty quintiles, the directions of the relationships largely hold, and higher quintiles of commonality/uncertainty (Quintiles 5 and 4) demonstrate more statistical significance compared to their matched lower commonality/uncertainty quintiles. Overall, our results continue to hold after controlling for the differences in firm characteristics and disclosure environments between firms with high vs. low commonality and uncertainty among analysts.

2.6.6 *Other analyses*

We examine the robustness of our results using several additional analyses. First, we examine the possibility that managers refrain from disclosing their private information when uncertainty is high, so that they can take advantage of this private information and mask their informed insider trades in an uncertain environment. However, we do not find any evidence of such behavior; insider trading does not appear to be concentrated in firms with high uncertainty that are less likely to provide guidance.

We also include additional controls for market-wide variables, such as the average bid-ask spread and return volatility. The concern is that our analyst variables capture some market-wide characteristic, such as market uncertainty, which is the real driver of guidance and not analysts' incentives. The inclusion of these additional variables does not alter our results, suggesting that our measures of uncertainty and commonality capture the analyst characteristics they purport to measure, beyond other market-wide constructs. Moreover, we find that bid-ask spread and daily return volatility prior to disclosure are negatively related to guidance.

Our next supplementary analysis examines whether managers substitute guidance for another form of disclosure. One of our main results is that management guidance becomes less likely as earnings forecast uncertainty increases. It is possible that managers still want to respond to analysts' incentives to develop private information, despite their own increased uncertainty, via another, potentially less costly form of disclosure. Therefore, we consider conference calls as an alternative form of voluntary disclosure that managers may go to, particularly when their uncertainty is high. However, we do not find any evidence that management uses conference calls strategically as a way of meeting analyst demand for information; neither uncertainty nor commonality is related to the incidence of providing a conference call.

Finally, we examine the results in the pre- and post-Regulation FD and find that the relations are stronger in the post period. This is to be expected because analysts are likely to rely more on public sources of disclosure, such as guidance, in the post-relative to the pre-Regulation FD period. However, we note that we have limited data in the pre-period and the apparent differences may be due to lack of power using the much smaller pre-Regulation FD sub sample.

2.7 Conclusion

We investigate how analysts' incentives to develop private information affect firms' discretionary forecast disclosure decisions and forecast consequences. Our findings show that analysts' private information incentives serve as a forecast antecedent and affect subsequent analyst forecast revision and trading volume. Our results suggest managers consider what information analysts need in making earnings forecasts to achieve immediate responses from market participants. We also demonstrate that direct measures for the relative importance of analysts' idiosyncratic information (such as the commonality of information in analysts' forecasts) would provide more reliable inferences about the interactions between analysts' private information incentives and management earnings forecasts, compared to other alternatives (such as analysts' uncertainty and forecast dispersion).

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Appendix 2A: Theoretical Framework

A firm has underlying earnings of x_i at state i, where $i = H, L$ represents the states of nature, and we assume $x_H > x_L$, i.e., state H is considered more favorable than state L. For simplicity, we assume equal prior probabilities of the firm being in states H and L. The manager of the firm learns some private but imperfect information, $\tilde{s}$, that is stochastically associated with the underlying earnings. There is no credible way for the manager to convey the value of $\tilde{s}$ to the capital market directly due to the non verifiable nature of his private information. We characterize the overall quality of $\tilde{s}$ by a parameter, $r \in (0, 1]$, such that for any $s \in (0, 1]$, the conditional densities on the underlying states, $f\,(s\,|\,x_H)$ and $(s\,|\,x_L)$, take the following form[14]:

$$\begin{cases} f(s|x_H, r) = (1 - r) + 2rs \\ f(s|x_L, r) = (1 + r) - 2rs. \end{cases}$$

After learning $\tilde{s}$, the manager has the option to issue a voluntary disclosure, D. Then the firm is sold after D, if any, is released. Later, the underlying earnings is revealed. If the underlying earnings is contained in D, the game is over. However, if the underlying earnings is not contained in D, the manager will need to pay a personal penalty of c.[15] All shareholders are assumed to be risk-neutral, and the binary nature of the states, the associated prior probabilities of the states, and the stochastic nature of the signal, given the states, are common knowledge. The manager's objective is to maximize a fraction, α of the share price at the voluntary disclosure stage, net the expected penalty for missing the expectation. The parameter, α, is introduced to capture the market demand for management guidance. A greater α may dampen the price change arising from disclosure through analysts' and investors' demand for information.

The set-up is quite standard. The empirical literature has generally documented two effects of managers' earnings forecasts: effect on firms'

[14]It is easy to verify that higher s represents more favorable news in the sense that it is more likely to be generated under the high state, H, and higher r indicates that $\tilde{s}$ is more informative about the underlying state.

[15]The penalty c is a more general way of imposing constraints on manager's voluntary disclosure. In the earlier literature (e.g., Grossman 1981, Dye 1985, and Shin 1994), this penalty is assumed to be infinity. We assume that relative to the outcome differences between the two states, the penalty should not be too small or too large. The intuition is straightforward — if c is too small, then the manager will almost always ignore the signal and disclose the state is H; on the other hand, if the penalty is too large, then the manager will always ignore the signal and disclose the state is L. Technically, $\frac{1}{r} - 1 < \frac{x_H - x_L}{c} < \frac{1}{r} + 1$.

share prices at issuance (Pownall and Waymire, 1989; Pownall, Wasley, and Waymire, 1993), and the consequences subsequent to issuance such as drops in share prices (Matsumoto, 2002; Lopez and Ree, 2002) and loss of bonuses and reputation by managers (Matsunaga and Park, 2001; Kasznik, 1999) when forecasts are missed, or upward earnings management to avoid falling short of forecasts (Burgstahler and Dichev, 1997; Soffer, Thiagarajan and Walther, 2000).

Because the state of nature is binary, the only two possible voluntary disclosures are (1) D $= \{\phi\}$, i.e., silence, interpreted in equilibrium as earnings being either x_L or x_H; and (2) D $= \{x = x_H\}$, interpreted as earnings being x_H.[16] Intuitively, if the manager remains silent at the voluntary disclosure stage, there will be no penalty no matter what the underlying earnings is; however, if the manager discloses $D = \{x = x_H\}$, and it turns out that the underlying earnings is x_L, the manager incurs a personal cost c. The price of the firm is determined by the new investor's inference of the firm's value based on the manager's disclosure. We derive the following equilibrium.

Claim: There exists a threshold, $s^* \epsilon (0, 1)$, of the manager's information $\tilde{s}$, where the manager applies a switching-strategy: if $s \geq s^*$, he voluntarily discloses that earnings is x_H, and if $s < s^*$, he remains silent; the new investors rationally anticipate the manager's disclosure, and price the firm accordingly. Furthermore, the threshold value s^* satisfies $s^* = \frac{1+r}{2r} - \alpha \frac{x_H - x_L}{2c}$. Further, $\frac{\partial s^*}{\partial r} = -\frac{1}{2r^2} < 0$; $\frac{\partial s^*}{\partial c} = \frac{\alpha}{c} \frac{x_H - x_L}{2c} > 0$; and, $\frac{\partial s^*}{\partial \alpha} = -\frac{x_H - x_L}{2c} < 0$.

Proof. We conjecture that the manager adopts a switching-strategy when he observes a noisy signal s, i.e., the manager chooses to voluntarily disclose that earnings is x_H when he observes a signal $s \geq s^*$, where s^* is some threshold to be endogenously determined later, and chooses to keep silent when he observes a private signal $s < s^*$. Given this conjecture, the investors respond to the voluntary disclosure by setting the price of the firm in the following way:

$$\begin{aligned} P\,(D = \{x = x_H\}) \\ &= x_H \times p(x = x_H | D = \{x = x_H\}) \\ &\quad + x_L \times [1 - p(x = x_H | D = \{x = x_H\})], \end{aligned} \tag{2A.1}$$

[16] $D = \{x \geq x_L\}$ is another option, but in equilibrium, this will be interpreted the same as silence, i.e., earnings is at least x_L (or earnings is either x_L or x_H). We assume that the manager will remain silent when he is indifferent between keeping silent and making a disclosure of $D = \{x \geq x_L\}$.

where,

$$\begin{aligned} p(x = x_H|D = \{x = x_H\}) \\ &= \frac{p(D = \{x = x_H\}|x = x_H)p(x = x_H)}{p(D = \{x = x_H\})} \\ &= \frac{p(D = \{x = x_H\}|x = x_H)p(x = x_H)}{\sum_{i=L}^{H} p(D = \{x = x_H\}|x = x_i)p(x = x_i)}. \end{aligned} \tag{2A.2}$$

Using the conjectured manager's strategy, we have

$$\begin{aligned} p(D = \{x = x_H\}|x = x_i) &= p(s \geq s^*|x = x_i) \\ &= \int_{s^*}^{1} f(s|x_i)ds) \equiv 1 - F(s^*|x_i), \end{aligned} \tag{2A.3}$$

where $F(.)$ is the cumulative distribution function of $\tilde{s}$ conditional on x_i.

Inserting equation (2A.3) into equation (2A.2), we have

$$p(x = x_i|D = \{x = x_H\}) = \frac{[1 - F(s^*|x_i)]p_i}{\sum_{i=L}^{H}[1 - F(s^*|x_i)]p_i}. \tag{2A.4}$$

Thus, we have

$$\begin{aligned} p(D = \{x = x_H\}) \\ &= x_H \times \frac{(1 - F(s^*|x_H))\, p_H}{(1 - F(s^*|x_H))\, p_H + (1 - F(s^*|x_L))\, p_L} \\ &\quad + x_L \times \frac{(1 - F(s^*|x_L))\, p_L}{(1 - F(s^*|x_H))\, p_H + (1 - F(s^*|x_L))\, p_L} \\ &= \frac{1 + rs^*}{2} x_H + \frac{1 - rs^*}{2} x_L. \end{aligned} \tag{2A.5}$$

Similarly, we have

$$p(D = \{\emptyset\}) = \frac{1 - r + rs^*}{2} x_H + \frac{1 + r - rs^*}{2} x_L. \tag{2A.6}$$

Given this pricing schedule, the manager will adopt a threshold strategy if and only if the manager's expected benefit as a function of his disclosure choice exceeds the costs associated with a disclosure:

$$\begin{aligned} \alpha[P(D = \{x = x_H\}) - P(D = \{\emptyset\})] \\ \geq p(\text{the manager incurs a penalty } |s^*) * c. \end{aligned} \tag{2A.7}$$

Based on the probability structure, we know that

$$\begin{aligned} &p(\text{the manager incurs a penalty } |s^*) \\ &\quad = p(D = \{x = x_H\},\ \text{but } x = x_L|s^*) \\ &\quad = 1 - p(x_H|s^*) \\ &\quad = \frac{1 + r - 2rs^*}{2}. \end{aligned} \tag{2A.8}$$

Insert equation (2A.8) into equation (2A.7), we show that the manager will choose to disclose $D = \{x = x_H\}$ over keeping silence if and only if $\mathrm{s}^* = \frac{1+\mathrm{r}}{2\mathrm{r}} - \alpha \quad \frac{x_H - x_L}{2\mathrm{c}}$.

The comparative statics results can be obtained by taking the partial derivatives of the expression for s^* with respect to each argument directly.

Appendix 2B: Estimation of the Conditional Variance $\boldsymbol{\sigma^2_{\lambda_t}}$ by GARCH Models

(1) GARCH(1, 1) model specification:

The simple GARCH(1, 1) model specification at horizon h is

$$\begin{aligned} e_t = \phi_0 + \phi_1 \varepsilon_{t-1} + \ldots + \phi_{h-1} \varepsilon_{t-(h-1)} \\ + \varepsilon_t,\ \varepsilon_t\,|\Psi_{t-1} \sim N(0, \sigma^2_{\lambda_t}), \end{aligned} \tag{2B.1}$$

$$\sigma^2_{\lambda_t} = \alpha_0 + \alpha_1 \varepsilon^2_{t-1} + \alpha_2 \sigma^2_{\lambda_{t-1}}. \tag{2B.2}$$

The mean equation in (2B.1) is written as a function of a constant, moving average terms, and an error term. Since $\sigma^2_{\lambda_t}$ is the one-period ahead forecast variance based on past information set Ψ_{t-1}, it is called the conditional variance. The conditional variance equation specified in (2B.2) is a function of three terms: (i) a constant term, α_0; (ii) news about volatility from the previous period, measured as the lag of the squared residual from the mean equation, ε^2_{t-1} (the ARCH term); and (iii) the last period's forecast variance, $\sigma^2_{\lambda_{t-1}}$ (the GARCH term).

(2) Steps in estimating the conditional variance:

(1) For each firm, year and horizon, calculate the mean forecast error across analysts' earnings forecasts, e_{th}.[17]

[17] Firm subscript is omitted.

(2) Remove the possible bias and autocorrelation in the mean forecast error, e_{th} by fitting moving average (MA) models of varying order. Theoretically, optimal forecasts h steps ahead have dependence of order $h-1$. Hence at Horizon 1 one should fit a MA(0), at Horizon 2 — a MA(1) and at Horizon 3 — a MA(2) model.
(3) Estimate the GARCH(1, 1) model.
(4) Generate the conditional variance $\hat{\sigma}^2_{\lambda_{th}}$ using estimated model parameters.

(3) Some implementation details:

The pre-programmed routines for the estimation of GARCH models are contained in most software, including Stata, Eviews and SAS. Very often, equations (2B.1) and (2B.2) are estimated at the same time in the program such that steps 2 and 3 can be combined. For example, in Stata this is done by using the following command:

arch error, arch(1) garch(1) ma(*h-1*) [*options*]

where error is the mean forecast error, calculated in step 1.

Here we briefly discuss some implementation details involved in model estimation.

(1) *Distributional assumptions*: We estimate GARCH(1, 1) model by the method of maximum likelihood under the assumption that the errors are conditional normally distributed. Other distribution assumptions, such as t-distribution and the generalized error distribution, are also worth trying.
(2) *Number of ARCH and GARCH terms*: We use one ARCH and one GARCH term, i.e., GARCH(1, 1) model. One can also try a GARCH(p, q) model, where p is the order of the moving average ARCH terms and q is the order of the autoregressive GARCH terms.
(3) *Initial variance* $\sigma^2_{\lambda_0}$: In our analysis we set the initial variance $\sigma^2_{\lambda_0}$ using the unconditional variance in the sample. As a robustness check, we also set $\sigma^2_{\lambda_0}$ using the backcasting procedure. The estimation results are similar.
(4) *Iterative estimation control*: We use the iterative algorithm, Marquardt in our estimation. As is well known, the likelihood functions of GARCH models are not always well-behaved so that convergence may not be achieved with the default setting in the particular software. One can select other iterative algorithm, such as BHHH, increase the maximum number of iterations or adjust the convergence criterion.