

**An Empirical Examination of Horizon:
Evidence from the Term Structure of Implied Equity Volatilities**

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Abstract

We develop and test measures of the horizon of firm uncertainty and of the horizon of managers' corporate disclosures. The measures exploit information in the term structure of implied equity volatilities to gauge the relative extent to which the information underlying securities prices reflects long-term versus short-term uncertainty. We find that the horizon of firm uncertainty measure is associated with variables that are likely to capture the extent to which firms' business models result in differing degrees of uncertainty about the long-term versus the short-term. The horizon of managers' corporate disclosures measure allows us to characterize managers' disclosures in terms of whether they provide information about long-term business strategies or are more oriented towards short-term operating results. We find that earnings announcements containing management forecasts have shorter disclosure horizons than earnings announcements not containing management forecasts.

Keywords: corporate disclosure, short-term focus, earnings guidance, uncertainty, horizon

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I. INTRODUCTION

In this paper, we develop and test measures of the horizon of firm uncertainty and of the horizon of managers' corporate disclosures. These measures exploit information in the term structure of implied equity volatilities to gauge the relative extent to which the information underlying securities prices reflects long-term versus short-term uncertainty about firm value. The uncertainty about firm value reflected in the term structure of implied volatilities captures the precision of investor information over various horizons. We expect the precision of investor information over various horizons to vary as a function of firm characteristics and changes in it around earnings announcements to reflect the nature of the information released. Thus, examining the term structure of implied volatilities allows us to characterize management disclosures in terms of whether they provide information to investors about long-term business strategies or are more oriented towards short-term operating results.

Bushee and Noe (2000) suggest that managers, through their disclosures, can affect their firm's investor base (i.e., the composition of short-term and long-term investors that trade their firm's stock). Managers care about their firm's investor base because short-term investors increase volatility (Bushee and Noe, 2000; Bushee, 2004). This increase in volatility increases the chances of large stock price declines. Poor stock price performance can hurt the manager's reputation and increase the probability that the manager gets terminated (e.g., Warner et al., 1988). Increased volatility can also increase the perceived riskiness of the firm and result in an increase in the firm's cost of capital (Froot et al., 1992). To the extent that relatively long-term disclosures repel short-term investors and attract long-term investors, managers can reduce the capital market pressure for short-term results, thus increasing the manager's ability to take on long-term value maximizing projects (Bushee, 1998, 2001, 2004).

Measuring the horizon of a manager's disclosures is complicated by the fact that the horizon over which investors' expectations change is not directly observable. Many papers examine the informativeness of various corporate disclosures, which is typically derived from the stock market reaction to the disclosure.¹ However, the stock market reaction aggregates long-term and short-term changes in investors' expectations and, therefore, is not useful in distinguishing between the short-term and the long-term. On the other hand, investors' uncertainty about firm value is also affected by corporate disclosures and can be measured over various horizons. Therefore, we examine the horizon of corporate disclosures by utilizing the duration of different implied volatilities from exchange-traded options to measure uncertainty about firm value over multiple horizons.² In other words, we exploit observable standardized implied equity volatilities of different durations to estimate the relative amount of short-term versus long-term information, or the horizon of a firm's disclosure.

Our horizon measure captures the extent to which a firm faces relatively short-term versus long-term uncertainty. To calculate this measure, we first compute forward implied volatilities over each of the next four 91-day periods within a broader 365-day horizon.³ We then measure the proportion of the 365-day (the longer-term period) implied volatility expected to occur within each of the four 91-day periods (the interim periods) and use these proportions to weight the horizon of the corresponding 91-day period to arrive at a volatility-weighted duration,

¹ Representative studies include Ball and Brown (1968), Ball and Shivakumar (2008), Foster (1973), Patell (1976), Penman (1980), Ajinkya and Gift (1984), Waymire (1984), Baginski et al. (1993), Skinner (1994), Miller (2002), Hutton et al. (2003), Milian (2010), Griffin (2003), Li and Ramesh (2009), Lerman and Livnat (2009), Bryan (1997), and Brown and Tucker (2011).

² Implied volatility is the market's expectation of the average stock return volatility over the duration of the option contract and is equal to the volatility implied by the option's price and an option pricing model such as the Black-Scholes model or the Cox-Ross-Rubinstein binomial tree model.

³ Implied volatility refers to the expected volatility over the life of the option contract, while forward implied volatility refers to the expected volatility over a sub-period of the option contract that starts after the beginning of the option contract.

or horizon. For example, if the forward volatilities are constant over the interim periods, then the volatility-weighted duration, or *Horizon*, equals 180 days (approximately equal to $\frac{1}{2} \times 365$ days). If the earlier 91-day periods have larger (smaller) implied volatilities than the later 91-day periods, then *Horizon* is less (greater) than 180 days. In other words, smaller values of *Horizon* indicate that underlying security prices reflect relatively more short-term uncertainty about firm value, while larger values of *Horizon* indicate relatively more long-term uncertainty. Thus, *Horizon* measures how total uncertainty is distributed through time and will capture whether firm information reflects relatively more long-term or short-term uncertainty.⁴

We validate the *Horizon* measure by regressing *Horizon* on variables that are likely to capture the extent to which a firm's business model results in differing degrees of long-term versus short-term uncertainty about firm value. In the cross-section, we find that *Horizon* increases in a firm's R&D intensity and growth opportunities, which is consistent with the long-term nature of these types of activities. In addition, we find that firms in industries with longer product development cycles (e.g., aircraft) have relatively more long-term uncertainty than firms in industries with shorter product development cycles (e.g., steel). In contrast, firms reporting accounting losses face relatively more short-term uncertainty. At the macroeconomic level, we find that firms face relatively more short-term uncertainty at the time of large, negative market-wide shocks (e.g., during the financial crisis of 2008). The higher short-term uncertainty for loss firms and at the time of large, negative market-wide shocks is consistent with the relatively short-term nature of distress and liquidity issues. Also, we document that large firms and stable

⁴ In this paper, we focus on the *relative* amount of "short-term" versus "long-term" nature of information within the context of a 365-day time period. We acknowledge that variation in uncertainty about firm value that extends well beyond our 365-day window is also of considerable interest. However, our study is constrained to a 365-day window because implied volatilities any further into the future are generally not available. Implied equity volatilities up to 730 days are available for a very limited number of firm-years. In untabulated tests, we find that the 730-day *Horizon* is 85% correlated with our 365-day *Horizon* for this limited sample. This provides *prima facie* evidence that the 365-day *Horizon* measure used throughout this study captures a significant portion of the distribution of information uncertainty over relatively longer time horizons.

firms (i.e., low volatility over the past year) are associated with relatively less short-term uncertainty. Finally, we document that *Horizon* is positively associated with the dispersion in analysts' earnings forecasts for the next fiscal year relative to the dispersion in analysts' earnings forecasts for the current fiscal year (i.e., a measure of the term structure of the dispersion in analysts' earnings forecasts), which provides additional validation for our *Horizon* measure. Overall, our analysis suggests that the term structure of implied equity volatility can be used to extract important information about the relative amount of short-term versus long-term uncertainty that firms face and how investors react to this information around earnings announcement disclosures.

To assess a firm's *Disclosure Horizon*, we next examine changes in implied volatilities of various durations around corporate disclosures.⁵ A firm's *Disclosure Horizon* captures the relative proportions of the precision of short-term versus long-term information about uncertainty conveyed by the firm's disclosures.⁶ Using this measure, we address the popular debate about whether the issuance of earnings guidance is associated with a short-term focus. Given that a large proportion of earnings guidance occurs at earnings announcements, we

⁵ Implied volatilities are available on a daily basis which makes them useful for studying information releases such as earnings announcements, management forecasts, and conference calls.

⁶ Our measure of *Disclosure Horizon* measures how changes in investors' expectations of firm uncertainty are relatively distributed through time (i.e., short-term vs. long-term), which is very distinct from changes to the *magnitude* of uncertainty, which was examined in Rogers et. al (2009). To illustrate this important difference, consider two firms, A and B, for which investors form expectations about firm uncertainty over two horizons, short-term (e.g., first 6 month period) and long-term (e.g., second 6 month period). Assume that investors' expectations over firm A's uncertainty is 0.60 over both the short-term period and the long-term period, but their expectations over firm B's uncertainty is 0.20 and 0.30 over the short-term period and long-term period, respectively. In this case, the *magnitude* of firm A's uncertainty is higher on average and in both periods than the *magnitude* of firm B's uncertainty. However, firm B would have a higher *Disclosure Horizon* (i.e., relatively more long-term) than firm A because relatively more of firm B's total uncertainty is concentrated in the long-term period (i.e., $0.30/(0.30 + 0.20) = 60\%$) compared to the concentration of firm A's total uncertainty in the long-term period (i.e., $0.60/(0.60 + 0.60) = 50\%$). Thus, while the *magnitude* and *Horizon* measures we consider in this paper are both important dimensions of firm uncertainty to understand, the two measures do not capture the same phenomenon (as illustrated by opposing classifications in the above example). While prior research, such as Rogers et. al (2009), has examined the effect of firm disclosures on the *magnitude* of uncertainty, the focus of our paper is on the effect on the temporal distribution (or *horizon*) of uncertainty, irrespective of the *magnitude* of that uncertainty.

examine whether bundled earnings announcements (i.e., earnings announcements containing management forecasts or earnings guidance) are relatively more short-term or long-term information events than non-bundled earnings announcements (earnings announcements not containing management forecasts or earnings guidance).

Our regression analysis suggests that, on average, bundled earnings announcements are associated with shorter disclosure horizons than non-bundled earnings announcements. In addition, there is relatively greater open interest in short-term options prior to bundled earnings announcements. This is consistent with bundled earnings announcements containing a larger proportion of short-term information than non-bundled earnings announcements and supports the view that issuing earnings guidance is associated with a greater short-term focus by managers and investors. We also find that earnings announcement conference calls are associated with longer disclosure horizons for firms that issue earnings guidance. These results indicate that when a firm has both an earnings forecast and conference call, the short-term nature of the forecast is at least partially offset by other relatively long-term information contained in the conference call. In other words, hosting a conference call can help to reduce some of the short-term focus created by an earnings forecast. This paper makes several contributions. First, this is the first examination of the term structure of implied equity volatilities on a large scale at the firm level. Second, the *Horizon* measure allows future research to distinguish between firms facing relatively short-term uncertainty and firms facing relatively long-term uncertainty. Third, the *Disclosure Horizon* measure allows researchers to determine the relative amounts of short-term and long-term information in a disclosure. This will potentially further our understanding of the nature of the information in various disclosures and how this attribute of disclosure differs across manager and/or firm characteristics. Fourth, we introduce the use of the relative amount

of open interest in short-term options as a proxy for the amount of transient investors in a stock. Fifth, we provide empirical evidence that the provision of earnings guidance tends to be associated with a greater short-term focus by managers and investors. Sixth, our finding that earnings conference calls reduce the short-term focus of bundled earnings announcements suggests that conference calls are a useful voluntary disclosure medium for conveying longer-term information.

Section II discusses prior research. Section III discusses how we measure horizon and disclosure horizon. Section IV develops empirical predictions. Section V describes our sample and data. Section VI reports our empirical results. Section VII concludes.

II. PRIOR RESEARCH

Disclosure and Uncertainty

Prior research on the relation between disclosure and uncertainty focuses on how disclosure affects the magnitude of uncertainty. Patell and Wolfson (1979, 1981) and Isakov and Perignon (2001) find that implied volatility (a proxy for uncertainty) increases before a firm's earnings announcement and decreases following the announcement. Subramanyam et al. (2005) present a model where large earnings surprises (both positive and negative) increase uncertainty. Clement et al. (2003) find that confirming management forecasts do not affect the mean of the consensus analyst forecast but do reduce the dispersion of the analyst estimates. Ng et al. (2009) present a model and empirical evidence in which firms that report poor performance tend to experience increases in future earnings volatility. Rogers et al. (2009) examine how management forecasts affect uncertainty over various option durations. They find that management forecasts, on average, increase uncertainty over various option durations (i.e.,

implied volatility increases in the days around the forecasts). Kim et al. (2010) find that there is a decrease in management forecasts during periods of high uncertainty. In contrast to these papers on the relation between disclosure and the magnitude of uncertainty, our paper abstracts away from the magnitude of uncertainty and focuses on how the relative duration or horizon of uncertainty is affected by disclosure. By analyzing changes in a firm's term structure of implied volatility, our goal is to infer the relative amounts of short-term and long-term information in a firm's disclosure.⁷

Short-term Focus and the Investor Base

The importance of the distinction between long-term and short-term information is most relevant to the literature on managers' horizon and the investor base. In a survey of managers, Graham et al. (2005) find that a surprisingly large number of managers admit to being willing to sacrifice long-run value to meet short-term earnings targets. Bhojraj and Libby (2005), in an experimental setting, find that managers' short-term focus is increasing in capital market pressure. They conclude that more frequent disclosure could increase managers' short-term focus in the presence of significant stock market pressure. Consistent with the results of this experiment, Gigler et al. (2009) present a model where frequent short-term disclosures result in managers' short-term focus due to information imperfections in the market between managers and investors. They show that frequent reporting or forecasting of results increases the premature evaluation of projects with values that are only determined in the long-term, which causes managers to avoid these projects in favor of ones that generate short-term results. Bushee and Noe (2000) find that disclosures that attract short-term investors increase volatility.

⁷ Van Buskirk (2011) examines the volatility skew dimension of the implied volatility surface and finds that high volatility skew predicts negative price jumps at earnings announcements, but not outside of earnings periods. Also, see Xing et al. (2010) and Jin et al. (2012).

Managers care about their firm's investor base because short-term investors increase volatility which can increase the firm's cost of capital, increase pressure for short-term results, and reduce the manager's job security. Managers, therefore, aim to build a dedicated investor base.

Concerns over managerial short-termism and disclosure are not limited to academic arenas. In his 2000 letter to shareholders, Warren Buffett stressed the importance of long-term strategy and not quarterly earnings. At the time Google went public, the founders established a disclosure policy of not providing earnings guidance due to the company's long-term focus. Likewise, several firms that had previously provided earnings guidance have stopped in order to keep their focus on the long-term (Deloitte 2012). A panel of the CFA Centre for Financial Market Integrity and the Business Roundtable Institute for Corporate Ethics recommended the abolition of quarterly guidance and a transition to "higher quality, long term, fundamental guidance practices" (Krehmeyer et al., 2006).⁸ In addition, a focus on short-term earnings is the second most important cost of providing guidance according to a 2006 McKinsey survey of CFOs, CEOs, and board members of publicly held companies (Hsieh et al., 2006).⁹ While these practitioners may strongly believe in the short-term nature of earnings guidance, there is no direct empirical evidence on how capital market participants interpret whether these disclosures provided relatively short-term or long-term information about firm value. Our study fills this void.

Distinguishing between short-term and long-term information of corporate disclosures from investors' perspectives is central to the debate about firms' disclosure practices (e.g., mandatory quarterly reporting, voluntary earnings forecasts), manager's horizon, and the firm's investor base. While the debate regarding earnings guidance goes beyond the nature of the

⁸ Similar recommendations are made in Schacht et al. (2007).

⁹ The survey finds the most important cost is management's time.

information in earnings guidance, that is whether the assumed short-term nature of earnings guidance affects managers' investment decisions, addressing whether or not earnings guidance is associated with short-term information is an important precondition in this debate and an empirical question that has not been answered.¹⁰ The aim of our study is to test whether or not this is the case by developing a measure to assess the relative amounts on short-term and long-term information in a disclosure from the capital market's perspective.

III. MEASURING HORIZON AND DISCLOSURE HORIZON

In this section, we provide details about the calculations of the *Horizon* and *Disclosure Horizon* measures.

Horizon

To analyze the information in the term structure of implied equity volatility, we create a measure that quantifies the slope of the term structure. Our horizon measure captures the extent to which a firm faces relatively short-term versus long-term uncertainty. *Horizon* is a volatility-weighted average duration. It is similar in spirit to the intraperiod timeliness (IPT) measure used in accounting studies to capture the speed of price discovery over a period of time (e.g., Alford et al., 1993; Brown et al., 1999; Beekes and Brown, 2006; Butler et al., 2007; Bushman et al., 2010). *Horizon* measures the average timing of uncertainty. Our approach assumes unbiased implied volatilities and efficiency in the options market.¹¹

¹⁰ Two papers examining the relation between earnings guidance and investment provide conflicting results. Cheng et al. (2007) find that firms which consistently provide earnings guidance invest less in R&D and have lower future growth rates, while Houston et al. (2010) find that firms do not increase investment after stopping the issuance of earnings guidance.

¹¹ Poon and Granger (2003) review evidence on the superior accuracy of implied volatilities relative to time-series models.

The first step in computing *Horizon* is to compute forward implied volatilities over a set of interim periods within a longer period. In this paper, the set of interim periods are four 91-day periods and the longer period is the 365-day period that contains the four 91-day periods.¹² Equation (1) generally defines the relation between the implied volatility of a first interim period ($\sigma^2_{t_0,t_1}$) that starts at t_0 and ends at t_1 , the forward implied volatility of a second interim period ($\sigma^2_{t_1,t_2}$) that starts at t_1 and ends at t_2 , and the implied volatility over the longer period ($\sigma^2_{t_0,t_2}$), that is made up of the two interim periods (i.e., it starts at t_0 and ends at t_2).¹³ For example, if the implied volatility (σ) from day 0 (t_0) to day 30 (t_1) is 0.21 and the implied volatility from day 0 to day 60 (t_2) is 0.20, then the implied volatility from day 30 to day 60 is 0.19.

$$\sigma^2_{t_0,t_2} = \frac{1}{t_2 - t_0} ((t_1 - t_0)\sigma^2_{t_0,t_1} + (t_2 - t_1)\sigma^2_{t_1,t_2}) \quad (1)$$

Using Equation (1) adapted to four sub-periods, we calculate forward implied volatilities for the second, third, and fourth 91-day periods. (It is not necessary to calculate the forward implied volatility for the first 91-day period because the implied volatility for the first 91-day period only captures the expected volatility over that 91-day period.) The second step is to measure the proportion of the total longer period volatility within each of the interim periods – the proportion of the 365-day volatility occurring during each of the four 91-day periods. Because implied volatilities (and therefore the calculated forward implied volatilities) are quoted on an annualized basis, we multiply the daily variances for the 91-day periods (365-day period) by 91 (365). Equation (2) expresses the sum of these proportions, which sums to one by

¹² We are limited to a 365-day horizon due to data constraints. Data is currently available on standardized options with durations as long as 730 days, but the data is limited in terms of the number firms and the length of the sample period. The usefulness of our approach increases as the liquidity in long-term options improves, as option exchanges expand the number of firms with LEAPS, and with the potential of even longer-term options than currently available being introduced in the future.

¹³ Equation (1) assumes that returns are independent over time and is in terms of variances (σ^2) because variances are additive while standard deviations (σ) are not additive.

construction because all of the 365-day period volatility must occur during the four 91-day periods.

$$\frac{\sigma^2_{t_0, t_{91}}(91)}{\sigma^2_{t_0, t_{365}}(365)} + \frac{\sigma^2_{t_{92}, t_{182}}(91)}{\sigma^2_{t_0, t_{365}}(365)} + \frac{\sigma^2_{t_{183}, t_{273}}(91)}{\sigma^2_{t_0, t_{365}}(365)} + \frac{\sigma^2_{t_{274}, t_{365}}(92)}{\sigma^2_{t_0, t_{365}}(365)} = 1 \quad (2)$$

The third and final step is to use these proportions to weight the duration of the corresponding interim period. The midpoints of the first, second, third, and fourth 91-day periods are 45, 135, 225, and 315 days, respectively. We use these midpoints as the durations of the four 91-day periods. Equation (3) is the formula for calculating *Horizon*.

$$Horizon = \frac{\sigma^2_{t_0, t_{91}}(91)}{\sigma^2_{t_0, t_{365}}(365)}(45) + \frac{\sigma^2_{t_{92}, t_{182}}(91)}{\sigma^2_{t_0, t_{365}}(365)}(135) + \frac{\sigma^2_{t_{183}, t_{273}}(91)}{\sigma^2_{t_0, t_{365}}(365)}(225) + \frac{\sigma^2_{t_{274}, t_{365}}(92)}{\sigma^2_{t_0, t_{365}}(365)}(315) \quad (3)$$

Horizon is measured in days. If the longer period is 365 days in length and forward volatilities are constant over the interim periods, then the volatility-weighted average duration or *Horizon* equals 180 days. Larger (smaller) values of *Horizon* indicate relatively more long-term (short-term) uncertainty. *Horizon* captures the distribution of uncertainty over time, and thereby whether firm information reflects relatively more long-term or short-term uncertainty.¹⁴

Disclosure Horizon

A firm's *Disclosure Horizon* captures the relative proportions of short-term and long-term information in a firm's disclosure by examining how disclosure affects the implied volatilities of various durations. For example, if a disclosure results in a relatively large change in the short-term implied volatilities, but results in relatively little change in the long-term implied volatilities, then we conclude that the disclosure is short-term in nature. Whereas, if the

¹⁴ To the extent that there is seasonal uncertainty within the year for some firms, error is introduced into *Horizon* for these seasonal firms.

disclosure affects long-term implied volatilities to a greater extent than short-term implied volatilities, then we conclude that the disclosure is long-term in nature.

The calculation of *Disclosure Horizon* is very similar to that of *Horizon* except for the following differences. We exclude the implied volatility over the first 30 days of the one year period from all implied volatilities when calculating *Disclosure Horizon*.¹⁵ We do this in order to remove the uncertainty due to the disclosure event itself from both the pre-announcement and post-announcement implied volatilities. This is important because the pre-release implied volatilities impound the anticipated impact of scheduled announcements (e.g., Patell and Wolfson, 1979, 1981; Ederington and Lee, 1996; Rogers et al., 2009; Billings and Jennings, 2011).

To calculate *Disclosure Horizon*, we first compute the absolute value of log changes in forward volatilities around a disclosure for each of the four 91-day periods. For example, Equation (4) measures the absolute value of the percentage change in the variance during the first 91-day period (excluding the first 30 days) at a disclosure:

$$|\ln(\sigma_{t_{31},t_{91}post}^2 / \sigma_{t_{31},t_{91}pre}^2)| \quad (4)$$

We then measure the proportion of the sum of the absolute value of log changes in volatility over the 365-day period that pertains to each of the four 91-day periods and use these proportions to weight the duration of the corresponding 91-day period. Equation (5) is the formula for calculating *Disclosure Horizon*.

Disclosure Horizon =

$$\frac{|\ln(\sigma_{t_{31},t_{91}post}^2 / \sigma_{t_{31},t_{91}pre}^2)| (45) + |\ln(\sigma_{t_{92},t_{182}post}^2 / \sigma_{t_{92},t_{182}pre}^2)| (135) + |\ln(\sigma_{t_{183},t_{273}post}^2 / \sigma_{t_{183},t_{273}pre}^2)| (225) + |\ln(\sigma_{t_{274},t_{365}post}^2 / \sigma_{t_{274},t_{365}pre}^2)| (315)}{|\ln(\sigma_{t_{31},t_{91}post}^2 / \sigma_{t_{31},t_{91}pre}^2)| + |\ln(\sigma_{t_{92},t_{182}post}^2 / \sigma_{t_{92},t_{182}pre}^2)| + |\ln(\sigma_{t_{183},t_{273}post}^2 / \sigma_{t_{183},t_{273}pre}^2)| + |\ln(\sigma_{t_{274},t_{365}post}^2 / \sigma_{t_{274},t_{365}pre}^2)|} \quad (5)$$

¹⁵ Standardized options data is not available for durations less than 30 days.

We use the absolute value of forward implied volatility changes to calculate *Disclosure Horizon* rather than signed differences because disclosure can cause uncertainty to increase or decrease. Clearly, disclosures regarding changes in firm risk can potentially increase or decrease uncertainty about firm value (e.g., Hughes and Pae, 2004). However, disclosures can increase or decrease uncertainty absent any explicit statements about firm risk. For example, uncertainty decreases as investors learn more about the parameters of the firm's earnings distribution through firm disclosures (e.g., Pastor and Veronesi, 2003). Alternatively, the unexpected nature of news can increase information asymmetry and volatility (e.g., Kim and Verrecchia, 1994). Similarly, management forecasts of negative news and management forecasts that are made by firms that do not typically forecast increase uncertainty about firm value (Rogers et al. 2009).

Because disclosure can introduce or resolve uncertainty, examining signed differences in uncertainty does not allow one to draw a clear inference about whether the information in the disclosure was relatively short-term or long-term in nature. For example, if *Horizon* increases, this could be due to an increase in long-term uncertainty (holding short-term uncertainty fixed) or due to a decrease in short-term uncertainty (holding long-term uncertainty fixed). Hence, the signed change in *Horizon* at disclosures is not informative about whether the disclosure contained relatively more short-term or long-term information.

Disclosure Horizon and *Horizon* are of similar magnitudes due to the way these two variables are scaled. However, their interpretations are quite different. A low value of *Horizon* indicates that a large proportion of the 365-day uncertainty about firm value is concentrated early in the 365-day period. On the other hand, a low value of *Disclosure Horizon* indicates that over a three-day period uncertainty about firm value regarding the early part of the 365-day period has

changed (either increased or decreased) to a greater extent than the uncertainty about firm value regarding the later part of the 365-day period.

IV. EMPIRICAL PREDICTIONS

Validating Horizon

In this section, we develop predictions used to test the validity of *Horizon* as a measure that distinguishes between firms facing relatively more short-term or long-term uncertainty.

Growth Opportunities

Myers (1977) presents the value of a firm as the sum of the value of assets already in place and the present value of future growth opportunities. The present value of these future growth opportunities depends on future discretionary investment by the firm. Smith and Watts (1992) document that firms with more growth options have lower leverage, lower dividend yields, higher executive compensation, and greater stock-option compensation. These relations are not surprising given that firms with high growth opportunities are valued to a greater extent on long-term potential than firms with low growth opportunities. The resolution of uncertainty regarding long-term potential takes time and is therefore more likely to occur later in the future. Therefore, we predict growth opportunities to be positively related to the relative amount of long-term uncertainty faced by a firm.

Firms invest in research and development because they have potential for growth. Kothari et al. (2002) document a positive relation between current R&D expenditures and the standard deviation of the next five annual earnings realizations. This suggests that R&D activities are positively related to uncertainty. Our interest is not in the magnitude of

uncertainty, but in the timing of uncertainty. We expect a firm's R&D expenditures to be positively related with the extent to which the firm engages in long-term projects whose uncertainty takes longer to resolve. Therefore, we predict a firm's R&D expense to be positively related to the relative amount of long-term uncertainty faced by the firm. We also predict R&D expense to have a stronger, positive relation to the relative amount of long-term uncertainty than capital expenditures because capital expenditures are less likely to be long-term projects for which uncertainty takes a long time to resolve.

Negative Shocks

Ng et al. (2009) find that poor earnings performance is associated with increases in firm risk. Ertimur (2004) finds that firms reporting losses are associated with greater information asymmetry than firms reporting profits. However, it is not clear whether the increased risk and greater informational asymmetry experienced by loss firms is due to short-term or long-term concerns. Accounting losses are indicative of negative shock to a firm (poor performance). To the extent that a firm must overcome this negative shock to survive, we expect accounting losses to be positively related to the relative amount of short-term uncertainty faced by a firm.

The leverage and "volatility feedback" effects predict equity volatility to increase after bad news (e.g., Black, 1976; Christie, 1982; French et al., 1987; Campbell and Hentschel, 1992). Negative market returns are indicative of negative shocks (bad news) to the economy. At the macroeconomic level, we expect short-term uncertainty to increase relative to long-term uncertainty at the time of negative market-wide shocks. For example, during the height of the financial crisis of 2008, the market was pricing the potential collapse of the United States

financial system. We expect investors to become relatively more concerned about the short-term during times of crisis because it is not clear whether there will even be a long-term.

Larger firms are typically more diversified, which makes large firms more stable and more likely to survive a temporary negative shock than small firms. Therefore, we expect firm size and firm stability to be negatively related to the relative amount of short-term uncertainty.

Product Development Cycles

Industries vary in the length of their product development cycles. Bushman et al. (1996) find that CEOs are more likely to be evaluated subjectively rather than with objective accounting measures when their firms have longer product development cycles. We expect long-term (short-term) uncertainty to be relatively greater for firms in industries with long (short) product development cycles.

Predictions about Disclosure Horizon at Earnings Announcements

If our disclosure horizon measure captures the relative amounts of short-term and long-term information in a disclosure, we expect *Disclosure Horizon* to be positively related to the horizon of the information provided by management. A proxy for the horizon of the information management discloses is the horizon of their earnings forecasts (i.e., the time between their earnings forecast and the actual earnings realization). Therefore, we expect a positive relation between the horizon of management's earnings forecasts and *Disclosure Horizon*.

Collins et al. (1994) show that a lack of earnings timeliness helps explain the low contemporaneous return-earnings association. This lack of timeliness is due to the fact that many economic events will not be captured in earnings until future periods. This lack of

timeliness increases with the amount of growth opportunities. For similar reasons other researchers find that accounting earnings are a relatively poor measure of performance for firms facing long-term uncertainty (e.g., Bushman et al., 1996; Amir and Lev, 1996; Aboody and Lev, 1998; Lev and Sougiannis, 1996; Tasker, 1998; Lev and Zarowin, 1999). Therefore, we expect the relative amount of long-term information in a firm's earnings announcements to be negatively related to the relative amount of long-term uncertainty faced by the firm.¹⁶

We also examine whether firms that issue earnings guidance with their earnings announcements provide relatively more short-term information than firms that do not issue earnings guidance with their earnings announcements. Critics of earnings guidance claim that earnings guidance either causes or is indicative of a short-term focus that is harmful to a firm's long-run value (e.g., Fuller and Jensen, 2002; Krehmeyer et al., 2006; Hsieh et al., 2006; U.S. Chamber of Commerce, 2007).¹⁷ However, there is little empirical evidence to support this claim, and this claim is not obviously true. For example, given that earnings guidance is a forward looking disclosure and that it is potentially positively correlated with other forward looking statements, it is conceivable that firms that issue earnings guidance provide relatively more long-term information than firms that do not issue earnings guidance. Therefore, we do not make a prediction regarding this empirical question.

¹⁶ We have no reason to believe that firms facing relatively high long-term uncertainty release information about their long-term projects with their earnings announcements to any large degree. For example, information regarding an FDA drug approval is more likely to be disclosed immediately rather than held until the firm's earnings announcement.

¹⁷ For a discussion on the costs and benefits of earnings guidance see: Miller (2009), Houston et al. (2010), and Chen et al. (2011).

V. SAMPLE AND DATA

We obtain at-the-money implied volatilities of constant durations from the OptionMetrics Standardized Options dataset.¹⁸ We require firms to have implied volatilities on standardized options from OptionMetrics for the following durations: 30, 91, 182, 273, and 365 days.¹⁹ We collect management forecasts from First Call, financial statement data from Compustat, stock market data from CRSP, and analyst forecast data from IBES. Our sample period is from January 2001 through October 2010. We start in January 2001 to ensure a consistent regulatory regime (Regulation Fair Disclosure was enacted towards the end of 2000) and because there are a relatively small number of firms prior to 2001.²⁰ Table 1 presents the number of sample firms, the percentage of these firms in the S&P 500 index, and the number of firm-quarters by year.

The number of firms increases over the sample period up until 2009 due to the increasing popularity of Long-term Equity Anticipation Securities (LEAPS).²¹ The reason for the large drop in the number of firms in 2009 and 2010 is unclear, but likely related to the financial crisis.²² LEAPS are the same as regular equity options except that these contracts are of a longer duration (i.e., durations greater than nine months). A firm must have LEAPS in order for there to be implied volatility data on standardized options with durations greater than 182 days. This requirement limits our sample to relatively large firms. Consistent with our sample covering the economically significant firms in the economy, our sample covers 73 percent of the market

¹⁸ These standardized implied volatilities are calculated by OptionMetrics using linear interpolation and a firm's traded options with strike prices around the current stock price and expirations around the desired constant duration.

¹⁹ Durations of 547 and 730 are also available on a more limited basis through OptionMetrics. In untabulated results, we find that *Horizon* is highly correlated (i.e., Pearson correlation coefficients greater than 0.85) with similar measures that take these longer durations (if and when available) into account.

²⁰ Data is available from OptionMetrics as far back as 1996.

²¹ The CBOE launched LEAPS in 1990.

²² The large drop in the number of firms in 2009 is not unique to the OptionMetrics database. A secondary source also shows a large decrease in the number of firms with LEAPS in 2009. For a current list of securities with exchange-traded LEAPS, see The Options Industry Council web-site.

capitalizations on average in each year during our sample period. In addition, 54 percent of sample firm-years are in the S&P 500 index.

Table 2 presents descriptive statistics for the firm-quarters in our sample and for the S&P 500 index option (SPX). *Horizon* is equal to a firm's volatility-weighted duration. When calculating *Horizon*, we average the implied volatilities of the previous five trading days to remove noise and to ensure that the firms' options trade regularly. Because we are interested in the relation between *Horizon*, which can be measured daily, and financial statement data, which is available quarterly, we select one day during the quarter to measure *Horizon*. Specifically, we measure *Horizon* 45 days after the firm's earnings announcement. We select 45 days because implied equity volatility exhibits a predictable pattern in the days around earnings announcements (e.g., Patell and Wolfson, 1979, 1981; Rogers et al., 2009). The mean and median of *Horizon* indicate that it is typical for firms to face slightly relatively more short-term uncertainty; the mean and median are both slightly less than 180 days, at 178 and 179 days, respectively. $Horizon_{SPX}$ is equal to the volatility-weighted duration for the S&P 500 index option (SPX), measured on the same days as the firm-level *Horizon*. In contrast to the individual firms, the mean and median of $Horizon_{SPX}$ are both greater than 180 days, at 185 and 186 days, respectively. The mean and median of $Horizon_{SPX}$ are greater than the mean and median of *Horizon*, which indicates that firms face relatively more short-term uncertainty than the market.

In order to illustrate how $Horizon_{SPX}$ varies over time, Figure 1 presents a graph of $Horizon_{SPX}$, measured each day of the sample. The graph shows that it is typical for there to be relatively more long-term uncertainty at the market level (i.e., $Horizon_{SPX}$ is usually greater than 180 days). However, at the time of negative market returns there appears to be relatively more

short-term uncertainty (e.g., late 2002 and late 2008).²³ This is consistent with our prediction about the relation between negative shocks and the horizon of uncertainty.

To investigate the relation between *Horizon* and variables designed to measure differences in the relative amounts of short-term and long-term uncertainty, we measure size as $\ln(\text{Assets})$, volatility (the opposite of stability) as σ_{365} , growth opportunities as $\ln(\text{MB})$, *R&D*, *R&D Indicator*, and *CapEx*, negative shocks as *Loss*, market-level horizon as $\text{Horizon}_{\text{SPX}}$, and product development cycles as $\text{PDC}_{\text{Short}}$ and PDC_{Long} .

$\ln(\text{Assets})$ is equal to the natural logarithm of the firm's most recent quarter's total assets. The median firm in our sample has approximately \$6 billion in total assets, which is relatively large compared to a median of approximately \$400 million for the universe of U.S. publicly traded firms during our sample period (untabulated). σ_{365} is the standard deviation of the firm's daily returns over the previous 365 calendar days.

$\ln(\text{MB})$ is equal to the natural logarithm of the firm's market-to-book ratio, which is the firm's current (45 days after the earnings announcement) market value divided by the firm's most recent quarter's book value of shareholder's equity. The median firm in our sample has a market-to-book ratio of 2.6 compared to a median of 1.9 for the universe of firms (untabulated). This indicates that firms with LEAPS have more growth opportunities than firms that do not. *R&D* is equal to the sum of the firm's R&D expense for the prior four quarters divided by the most recent quarter's total assets. *R&D Ind* is equal to one if *R&D* is greater than zero, and zero otherwise. *CapEx* is equal to the sum of the firm's capital expenditures for the prior four quarters divided by the most recent quarter's total assets.

²³ Callen and Lyle (2011) also find that the term structure became downward sloping in 2008.

Loss is equal to one if the firm's most recent quarter's income before extraordinary items is less than zero, and zero otherwise. Firms report losses in 20 percent of the firm quarters in our sample, which is a relatively low percentage.²⁴ This relatively low percentage reflects the profitable nature of firms with long-term exchange traded options which have a median return on assets of 4.5% compared to a median return on assets of 1.4% for the universe of firms (untabulated). The profitable nature of our sample firms supports our use of accounting losses as a measure of a negative firm-specific shock.

PDC_{Short} (PDC_{Long}) is equal to one if the firm's industry is classified as having a short (long) product development cycle in Bushman et al. (1996), and zero otherwise. The classification in Bushman et al. (1996) is adapted from a classification by the National Academy of Engineering. Because the classification is not exhaustive, some industries are classified as having neither a short nor a long product development cycle.

VI. EMPIRICAL RESULTS

Horizon, Firm Characteristics, and Market Conditions

In this subsection, we test our predictions about the validity of *Horizon* as a measure that distinguishes between firms facing relatively more long-term or short-term uncertainty. Table 3 presents Pearson and Spearman rank correlations for all of the variables of interest. Not surprisingly, *Horizon* is strongly associated with $Horizon_{SPX}$. This suggests that economic conditions similarly affect the relative timing of uncertainty for both firms and the market. As

²⁴ For example, Givoly and Hayn (2000) find that 34 percent of firm-years from 1991-1998 are loss years.

predicted, *Horizon* is positively related to $\ln(\text{Assets})$ and $\ln(\text{MB})$ and negatively correlated with Loss , σ_{365} , and $\text{PDC}_{\text{Short}}$.

In order to test our predictions, we estimate variations of the following regression (firm and time subscripts suppressed):

$$\begin{aligned} \text{Horizon} = & \beta_1 \ln(\text{Assets}) + \beta_2 \ln(\text{MB}) + \beta_3 \text{R\&D (or R\&D Ind)} + \beta_4 \text{CapEx} + \beta_5 \text{Loss} + \beta_6 \text{Horizon}_{\text{SPX}} \\ & + \beta_7 \text{PDC}_{\text{Short}} + \beta_8 \text{PDC}_{\text{Long}} + \beta_9 \ln(\text{OpInt}) + \beta_{10} \ln(\text{Vol}) + \beta_{11} \text{StOpInt} + \beta_{12} \text{StVol} + \\ & \beta_{13} \sigma_{365} + \text{Year-quarter fixed effects} + \varepsilon \end{aligned} \quad (6)$$

Table 4 presents the results.²⁵ *R&D* and *R&D Ind* are both positively related to *Horizon*. The coefficient on *R&D Ind* suggests that, on average, firms that invest in research and development have a *Horizon* that is 1.27 days longer than firms that do not invest in research and development. This means that more of the uncertainty about firm value for firms that invest in research and development occurs later relative to firms that do not invest in research and development. While 1.27 days may not appear to be of large economic significance, it is a relatively large proportion (about 10 percent) of the interquartile range and the standard deviation of *Horizon* (about 11 days). The variation in *Horizon* is naturally small given that its range is bounded between 45 and 315 and that all firms are going to have at least some uncertainty in each of the four interim periods. In addition, bear in mind that we are measuring the timing of uncertainty only within a 365-day period. Detecting differences in the timing of uncertainty using such an approach is decreasing in the extent to which one year does not represent the long-term for a firm. For example, if information regarding uncertainty about all of a firm's projects takes longer than one year to arrive, this approach would not conclude that such a firm faces relatively more long-term uncertainty.

²⁵All regression t-statistics in this paper are calculated based on two-way (by 2-digit SIC code and year-quarter) cluster-robust standard errors (e.g., Petersen, 2009; Gow et al., 2010) to correct for cross-sectional and time-series dependence.

Consistent with our prediction, we find that the coefficient on *R&D* is significantly greater than the coefficient on *CapEx*. This suggests that the uncertainty regarding research and development takes longer to resolve than uncertainty regarding capital expenditures. Also consistent with a positive relation between growth opportunities and long-term projects, we find that $\ln(MB)$ is positively related to *Horizon*.

Consistent with negative shocks shifting relative uncertainty towards the present, we find that losses are negatively related to *Horizon*. The coefficient on *Loss* suggests that, on average, firms that report an accounting loss for the previous quarter face a *Horizon* that is between 1.16 and 1.53 days shorter than firms that report profits. The coefficient on *Loss* in the fourth regression is insignificant due to its correlation with σ_{365} . This is not surprising because firms with a loss this quarter are more likely to have higher volatility during the past year than profitable firms. Also consistent with negative shocks shifting relative uncertainty towards the present, in untabulated results, we find that the coefficients on the year-quarter fixed effects tend to be greater during times of market strength (e.g., 2003–2004) and tend to be smaller during times of market weakness (e.g., 2008). For example, on average, firms' *Horizons* were more than 10 days shorter during the fourth quarter of 2008, which was a period of extreme market weakness, than they were during the first quarter of 2001.

As expected, we find that firm size, measured as $\ln(Assets)$, is positively related to *Horizon*. We also find that σ_{365} is negatively related to *Horizon*. These two results are consistent with larger firms and stable firms being more likely to be able to withstand a temporary negative shock.

We find that firms with short product development cycles have shorter horizons than average (i.e., firms classified as having neither short nor long product development cycles), in

the first and second regressions. In the first regression, we find that the coefficient on PDC_{Short} is significantly less (at the 10 percent level) than the coefficient on PDC_{Long} , which suggests that firms in short product development industries have shorter horizons than firms in long product development industries. This result is significant at the 5 percent level if $Ln(MB)$ and $R\&D\ Ind$ are excluded from the regression (untabulated). However, there is not a significant difference between the coefficients on PDC_{Short} and PDC_{Long} in the second, third, or fourth regressions.

$Horizon_{SPX}$ and the year-quarter fixed effects explain the large majority of the variation in $Horizon$. In untabulated results, a regression of $Horizon$ on solely these variables yields an Adj. R^2 of 16.99 percent, while the regressions in Table 4 have Adj. R^2 that range from 20.53 percent to 25.70 percent. This suggests that market-wide economic conditions play the most important role regarding the timing of uncertainty about firm value within a period of one year.

In the third and fourth regressions, we include controls for option liquidity and option investor interest. $Ln(OpInt)$ is equal to the natural logarithm of the total open interest of all exchange traded options for that firm. $Ln(Vol)$ is equal to the natural logarithm of the total volume of all exchange traded options for that firm. $StOpInt$ is equal to the proportion of the total open interest in exchange traded options with less than nine months to expiration. $StVol$ is equal to the proportion of the total volume in exchange traded options with less than nine months to expiration.²⁶ We measure $Ln(OpInt)$, $Ln(Vol)$, $StOpInt$, and $StVol$ on the same day as $Horizon$. Sample firms must have non-zero open interest and volume in their exchange traded options. To the extent that investor interest in short-term options drives up their implied volatilities, we expect $StOpInt$ and $StVol$ to be negatively related to $Horizon$.

²⁶Regular options generally have nine months or less to expiration. Only firms with LEAPS have options with greater than nine months to expiration. Because all of our firms have LEAPS trading, our $StOpInt$ and $StVol$ variables measure the proportion of open interest and volume in firms' non-LEAPS options.

We find that $Ln(OpInt)$ and $Ln(Vol)$ are negatively related to $Horizon$. This suggests that option investors prefer to trade options on firms with relatively higher short-term uncertainty. As expected the coefficients on $StOpInt$ and $StVol$ are significantly negative. This is consistent with greater trading in a firm's short-term options driving up the short-term implied volatilities relative to long-term implied volatilities which results in a smaller $Horizon$. The liquidity and investor interest control variables are important because they show that the results regarding firm characteristics and market conditions are not due to differing amounts of liquidity and investor interest.²⁷

An alternative explanation to some of these results regarding the term structure of implied volatilities and firm characteristics is that due to some behavioral or institutional bias option investors trade differently based on the firm characteristics that we have identified. For example, it could be the case that investors overpay for long-term options on firms with high R&D and underpay for long-term options on firms with low R&D. We leave it to future research to create and test a profitable option trading strategy that takes advantage of these potential biases.

Horizon and the Term Structure of the Dispersion in Analysts' Earnings Forecasts

To provide further evidence that $Horizon$ captures differences in investor uncertainty over different horizons, we test for an association between $Horizon$ and the term structure of the dispersion in analysts' earnings forecasts. Since analysts' uncertainty about earnings over various horizons is measurable through the dispersion in analyst estimates for these various horizons, a term structure of analyst uncertainty can be created which we call $AnalystTermSt$.

²⁷ The results in Table 4 are robust to using a non-continuous horizon measure. Specifically, we create a variable that is equal to one for the top 20 percent of the $Horizon$ measure by year-quarter, equal to zero for the middle 60 percent, and equal to negative one for the bottom 20 percent. This robustness test suggests that the results are not driven by outliers.

AnalystTermSt is equal to the standard deviation of analyst estimates for the firm's next fiscal year's earnings scaled by the median estimate for the next fiscal year divided by the standard deviation of analyst estimates for the firm's current fiscal year's earnings scaled by the median estimate for the current fiscal year.²⁸ It captures the amount of uncertainty over next year's earnings relative to the amount of uncertainty over this year's earnings.²⁹ The descriptive statistics in Table 3 show that analysts are, on average, nearly twice as uncertain about next year's earnings as they are about this year's earnings (mean of *AnalystTermSt* is 1.93).

Note, however, that *Horizon* captures uncertainty about firm value, while the term structure of the dispersion in analysts' earnings forecasts captures uncertainty about earnings. These are two distinct constructs, but should be positively related. To test this, we estimate the following two regressions (firm and time subscripts suppressed):

$$\begin{aligned} \text{AnalystTermSt} = & \beta_1 \text{Ln}(\text{Assets}) + \beta_2 \text{Ln}(\text{MB}) + \beta_3 \text{R\&D} + \beta_4 \text{CapEx} + \beta_5 \text{Loss} + \beta_6 \text{Horizon}_{\text{SPX}} + \\ & \beta_7 \text{PDC}_{\text{Short}} + \beta_8 \text{PDC}_{\text{Long}} + \beta_9 \text{Ln}(\text{OpInt}) + \beta_{10} \text{Ln}(\text{Vol}) + \beta_{11} \text{StOpInt} + \beta_{12} \text{StVol} + \\ & \beta_{13} \sigma_{365} + \text{Year-quarter fixed effects} + \varepsilon \end{aligned} \quad (7)$$

$$\begin{aligned} \text{Horizon} = & \beta_1 \text{Horizon}_{\text{SPX}} + \beta_2 \text{AnalystTermSt} + \beta_3 \#\text{Analyst}_{\text{St}} + \beta_4 \#\text{Analyst}_{\text{Lt}} + \beta_5 \text{Ln}(\text{OpInt}) + \\ & \beta_6 \text{Ln}(\text{Vol}) + \beta_7 \text{StOpInt} + \beta_8 \text{StVol} + \text{Year-quarter fixed effects} + \varepsilon \end{aligned} \quad (8)$$

Table 5 presents the results. The first regression in Table 5 is the same as the fourth regression from Table 4 except that the dependent variable is *AnalystTermSt* rather than *Horizon*. The purpose of this regression is to determine whether the independent variables load on *AnalystTermSt* in a similar fashion as they do on *Horizon*. *R&D*, *PDC_{Short}*, and σ_{365} have significant coefficients of the same sign as in Table 4. This suggests that, like option investors, analysts view firms with more R&D as having more uncertainty about the long-term and view

²⁸ Firms with a median earnings estimate less than \$0.10 per share for the current fiscal year or the next fiscal year are excluded to avoid problems with a small denominator.

²⁹ We focus on this year's and next year's earnings because the number of analysts making forecasts declines as one goes further out into the future.

firms from short product develop cycle industries and firms with greater past volatility as having more uncertainty about the short-term. The other variables in the regression do not have significant coefficients.

The second regression tests whether there is a positive relationship between *AnalystTermSt* and *Horizon*. We control for the number of analysts giving forecasts for the current year and next year because the presence of relatively more short-term forecasts suggests that short-term uncertainty may be inherently more important for the firm. $\#Analyst_{St}$ is equal to the number of analyst forecasts made during the current quarter for the firm's current fiscal year earnings. $\#Analyst_{Lt}$ is equal to the number of analyst forecasts made during the current quarter for the firm's next fiscal year earnings. We also control for market conditions with $Horizon_{SPX}$ and for option liquidity with $Ln(OpInt)$, $Ln(Vol)$, $StOpInt$, and $StVol$.

We find that the term structure of analysts' uncertainty is positively associated with *Horizon*. This confirms our expectation that the horizon of firm uncertainty is related to the relative uncertainty regarding earnings over different horizons. We also find that $\#Analyst_{St}$ ($\#Analyst_{Lt}$) is negatively (positively) related to *Horizon*. This suggests that a relatively higher number of near-term (longer-term) forecasts is associated with relatively higher short-term (long-term) uncertainty.

The advantage of *Horizon* over the term structure of analyst uncertainty is that it can be calculated on a daily basis, whereas analysts do not update their forecasts that frequently. Other advantages of *Horizon* are that uncertainty about stock price incorporates all sources of uncertainty (not just uncertainty about earnings) and that market-based sources of information are generally superior to other sources of information.

Disclosure Horizon and Earnings Guidance at Earnings Announcements

In this subsection, we test our predictions regarding the validity of *Disclosure Horizon* as a measure of the relative amounts of short-term and long-term information in a disclosure and whether earnings guidance is associated with relatively more short-term information. Table 6 presents descriptive statistics for the *Disclosure Horizon* measure and other variables for the full sample of earnings announcements and a sub-period of the full sample for which we obtained conference call data. In Panel A, the conference call subsample period is 2002 -2008, while in Panel B, the full sample period is 2001 – October 2010. *Disclosure Horizon* measures whether changes in implied volatilities at earnings announcements occur primarily in a firm’s short-term options or in a firm’s long-term options. $Horizon_{pre}$ is the firm’s volatility-weighted duration two days prior to the earnings announcement. $Horizon_{pre,SPX}$ is the SPX’s volatility-weighted duration two days prior to the earnings announcement. $Disclosure\ Horizon_{SPX}$ is equal to the volatility-weighted duration change for the S&P 500 index option (SPX), over the same three-day earnings announcement windows as the firms. The implied volatility for the first 30 days is excluded from the calculations of *Disclosure Horizon*, $Disclosure\ Horizon_{SPX}$, $Horizon_{pre}$, and $Horizon_{pre,SPX}$ to remove any effect due to the announcement itself from the variables. The mean of $Disclosure\ Horizon_{SPX}$ (155 days) is much less than the mean of *Disclosure Horizon* (180 days) at firms’ earnings announcements. In untabulated results, we find that this holds outside of firms’ earnings announcements as well. This suggests that day to day information is more short-term in nature for the S&P 500 than it is for the average firm.

$AnnRet$ is equal to the firm’s compounded three-day stock return during the earnings announcement window. $AnnRet^2$ is equal to $AnnRet$ squared. $OpenInt$ is equal to the natural logarithm of the total open interest prior to the earnings announcement window of all exchange

traded options for that firm. *StOpenInt* is equal to the natural logarithm of the proportion of the total open interest prior to the earnings announcement window in exchange traded options with less than nine months to expiration. *OpenInt* and *StOpenInt* are calculated the day prior to the three-day earnings announcement window.

Forecast Horizon is equal to the natural logarithm of the average of all the EPS forecast horizons that a firm bundled with an earnings announcement. *Forecast Horizon* is only calculated for earnings announcements that contained a management forecast of EPS. Each individual forecast horizon is equal to the difference between the end of the fiscal period being forecasted and the forecast date. The mean *Forecast Horizon* of 4.83 indicates that on average, managers provide earnings forecasts with an average horizon of 125 days when they provide earnings guidance with an earnings announcement.

Bundled is equal to one if the firm issued an EPS forecast within a three day window around their earnings announcement date, and zero otherwise. Consistent with Anilowski, Feng, and Skinner (2007) and Rogers and Van Buskirk (2012), a large percentage, 40 percent, of the earnings announcements in our full sample contain earnings guidance. 29 percent of the earnings announcements in Rogers and Van Buskirk (2012) contain earnings guidance. The larger percentage of bundled earnings announcements in our sample likely reflects the fact that our firms are much larger and of more interest to analysts and investors (which creates greater demand for earnings guidance).

Conf. Call is equal to one if the firm held a conference call within a three day window around their earnings announcement date, and zero otherwise.³⁰ Conference calls are held in 24 percent of our earnings announcements during the 2002 – 2008 period. *Bundled*Conf. Call* is equal to one if the firm both issued an EPS forecast and held a conference call within a three day

³⁰ Conference call dates were graciously provided by Michael Minnis.

window around their earnings announcement, and zero otherwise. 12 percent of earnings announcement in our conference call subsample provided earnings guidance and held a conference call.

To get an idea for the relations between the variables of interest, Table 7 presents Pearson and Spearman rank correlations for all of the variables of interest at earnings announcements. The strongest relation is the negative correlation between *Disclosure Horizon* and *Horizon_{pre}*. This suggests that the relative amount of short-term information increases as the relative amount of long-term uncertainty increases.

In order to test our predictions about the disclosure horizon of the information at earnings announcements, we estimate variations of the following regression (firm and time subscripts are suppressed):

$$\begin{aligned} \text{Disclosure Horizon} = & \beta_1 \text{Forecast Horizon} + \beta_2 \text{Bundled} + \beta_3 \text{Conf. Call} + \beta_4 \text{Bundled*Conf. Call} \\ & + \beta_5 \text{Horizon}_{pre} + \beta_6 \text{Horizon}_{pre,SPX} + \beta_7 \text{Disclosure Horizon}_{SPX} + \beta_8 \text{AnnRet} + \\ & \beta_9 \text{AnnRet}^2 + \text{Year-quarter fixed effects} + \varepsilon \end{aligned} \quad (9)$$

Table 8 presents the results of these regressions. *Horizon_{pre}* controls for the current shape of a firm's term structure and should capture any predictable movements in the term structure driven by its initial state. The initial state of the term structure (*Horizon_{pre}*), as shown earlier in Table 4, is driven by market conditions (e.g., the VIX index) and firm characteristics (e.g., growth opportunities), therefore we do not control for additional variables that are already neatly captured in *Horizon_{pre}*. *Horizon_{pre}* also allows us to examine whether firms with more long-term uncertainty have less long-term information in their earnings announcements. The significantly negative coefficient on *Horizon_{pre}*, in all three regressions, indicates that firms with relatively more long-term uncertainty have earnings announcements with relatively more short-term information (i.e., the information in their earnings announcements affects short-term uncertainty

relatively more than long-term uncertainty). This is consistent with accounting earnings not being as good a measure of performance for firms facing long-term uncertainty (e.g., firms with large investments in R&D and/or many growth opportunities).

$Horizon_{pre,SPX}$ and $Disclosure Horizon_{SPX}$ control for market conditions at the time of the earnings announcements. $AnnRet$ and $AnnRet^2$ control for the nature of the information released in terms of whether the announcement was good or bad news ($AnnRet$) and the magnitude of the news ($AnnRet^2$). Many volatility forecasting models use the sign and the magnitude of the innovation (i.e., the stock return) to predict volatility. These two variables should capture any changes in implied volatilities during the earnings announcement window due to expected volatility clustering or mean reversion related to the news itself but unrelated to the firm's disclosure policy.

In the first regression, the significantly (at the 10 percent level) positive coefficient on $Forecast Horizon$ indicates that longer horizon management forecasts are associated with a longer $Disclosure Horizon$. This result helps us validate that our disclosure horizon measure is capturing the relative amounts of short-term and long-term information in a disclosure. We also control for presence of conference calls in the first regression. When firms issue earnings guidance and hold a conference call, they have a $Disclosure Horizon$ that is three days longer than when they issue earnings guidance and do not hold a conference call. This suggests that managers are conveying longer-term information in their conference calls.

The significantly negative coefficient on $Bundled$ in the second regression indicates that firms that bundle earnings guidance with their earnings announcements, on average, have a $Disclosure Horizon$ that is nearly three days shorter than firms that do not bundle. This means that bundled earnings announcements affect short-term implied volatilities to a relatively greater

extent than they affect long-term implied volatilities, which suggests that there is relatively more short-term information in bundled earnings announcements than in non-bundled earnings announcements. This result is consistent with a positive association between the issuance of earnings guidance and a short-term focus. This result is also consistent with Rogers et al. (2009) who find that stand-alone management forecasts affect short-term implied volatility to a greater extent than long-term implied volatility. The significantly negative coefficient on *Bundled* holds in the third regression which controls for the presence of conference calls. Unlike in the first regression, the coefficient on *Conf. Call* is now significantly negative. This indicates that firms that hold conference calls but do not issue earnings guidance provide relatively short-term information in their conference calls. Consistent with the first regression, the interaction term, *Bundled*Conf. Call* is significantly positive which indicates that firms that both bundle and hold conference calls have longer disclosure horizons. Taken together, the coefficients on *Bundled* and *Bundled*Conf. Call* suggest that managers through conference calls can explain their forecasts or disclose additional information that shifts focus away from the short-term.

A potential concern is that bundled earnings announcements may contain more information than non-bundled earnings announcements and therefore are larger volatility shocks. These relatively larger volatility shocks for bundled earnings announcements are then reflected to a relatively greater extent in the short-term due to the mean reversion property of volatility resulting in a shorter disclosure horizon. We alleviate this concern in two ways. First, we control for the sign and the size of the volatility shock with *AnnRet* and *AnnRet*². Second, the correlation coefficients in Table 7 show that bundled earnings announcements are negatively correlated with the magnitude of the announcement news. This indicates that the bundled

earnings announcements in our sample actually contain less information than the non-bundled earnings announcements.

The significantly positive coefficient on *AnnRet* in the second and third regression indicates that the information at good news earnings announcements affects long duration options relatively more than the information in bad news earnings announcements. This is consistent with an asymmetry in which bad news inherently increases uncertainty more than good news (e.g., Black 1976; Christie 1982) and this increase in uncertainty is reflected to a greater extent in the short-term due to the mean reversion of volatility (e.g., Engle and Patton 2001). The significantly negative coefficient on $AnnRet^2$ in the second and third regressions is also consistent with mean reversion in volatility. In this case, earnings-related shocks affect volatility to a greater extent in the short-run and the effect dissipates over a longer horizon. This result also suggests that extreme earnings news is less persistent given that the short-term implied volatilities are affected to a greater extent than the long-term implied volatilities. If a piece of information is persistent (i.e. has long-term implications) it should affect the long-term volatilities just as much as the short-term volatilities, which is not the case with extreme news at earnings announcements. This is consistent with Freeman and Tse (1992) which document that the stock market's response to earnings news is nonlinear (i.e., the stock market responds less per unit of extreme news).

Open Interest in Short-Term Options at Bundled Announcements

In the previous subsection, we show that bundled earnings announcements are associated with relatively greater amounts of short-term information than non-bundled earnings announcements. We also show that longer management forecast horizons are associated with relatively greater amounts of long-term information. Bushee and Noe (2000) find that transient

institutions are drawn to firms with short-term information events. In this subsection, we examine whether there is more open interest in the short-term options prior to bundled earnings announcements and prior to bundled earnings announcements with relatively short forecast horizons. While all options trading is short-term to a certain extent, a trader in a 30-day contract is likely speculating or hedging in a way that differs greatly from a trader in a 365-day contract. To the extent that bundling earnings guidance with earnings announcements and management's forecast horizon is persistent and/or predictable and indicative of a firm's overall disclosure strategy, we expect "transient option investors", like the transient institutions in Bushee and Noe (2000), to be attracted to firms' short-term options and trade more heavily in them when firms provide relatively short horizon forecasts and when they bundle. To test this prediction, we estimate two variations of the following regression:

$$StOpInt = \beta_1 Forecast\ Horizon + \beta_2 Bundled + \beta_3 Horizon_{pre} + \beta_4 Horizon_{pre,SPX} + \beta_5 OpenInt + \text{Year-quarter fixed effects} + \varepsilon \quad (10)$$

Table 9 presents the results of these regressions. In the first regression, the significantly negative coefficient on *Forecast Horizon* indicates that longer forecast horizons are associated with less open interest in short-term options. This indicates that a firm giving a 90 day forecast has approximately 2% more open interest in short-term options compared to a firm giving a 365 day forecast. In the second regression, the significant coefficient of 0.0084 on *Bundled* indicates that firms that bundle their earnings announcement with earnings guidance have 0.84 percent more open interest in options with less than nine months to expiration than firms that do not bundle. This is consistent with more short-term trading in firms that bundle their earnings forecasts. The significantly negative coefficients on *OpenInt* indicate that the most popular and liquid option-listed firms have relatively more open interest in options with less than nine months to expiration. The significantly negative coefficients on *Horizon_{pre}* indicate that firms with

relatively more long-term uncertainty have relatively more open interest in their short-term options. Taken together the coefficients on *Forecast Horizon* and *Bundled* these results suggest that using open interest in short-term options prior to information events is a potentially useful proxy for detecting short-term trading activity and also potentially useful in evaluating the nature of a firm's disclosures. Future research should analyze the similarities and benefits of this approach compared to the Bushee (1998, 2001) classification.

VII. CONCLUSION

Using the term structure of implied equity volatilities, we develop a measure, *Horizon*, to capture whether a firm is subject to relatively more short-term or long-term uncertainty. We validate our measure by showing that it is positively related to R&D expenditures and growth opportunities. We also find that *Horizon* is positively related to firm size as well as firm stability and negatively related to accounting losses and negative market-wide shocks.

Using a similar approach, we develop a measure, *Disclosure Horizon*, which determines whether a firm's disclosure contains relatively more short-term or long-term information. We validate our measure by showing that it is positively related to the horizon of managers' earnings forecasts. We find that firms facing relatively more long-term uncertainty have earnings announcements that contain relatively more short-term information. This suggests that earnings announcements do not conveying long-term information for firms with high amounts of long-term uncertainty. We also find that bundled earnings announcements are associated with relatively more short-term information than non-bundled earnings announcements. This finding is consistent with earnings guidance being associated with a greater short-term focus by managers and investors. There is also greater trading in short-term options prior to bundled

earnings announcements compared to non-bundled earnings announcements and prior to bundled earnings announcements with relatively short horizon management forecasts. This suggests that the short-term information exhibited in earnings guidance attracts short-term investors.

Our *Horizon* measure is a market-based measure of a firm's duration which expands our understanding of the firm and its risks. For example, investors can use *Horizon* to anticipate the timing of major events and to determine whether a change in volatility is temporary or expected to persist. The relation between *Horizon* and future investment should be examined in future research, as well as, *Horizon*'s usefulness as a measure of market sentiment and the relation between *Horizon* and future returns (or cost of capital).

Our *Disclosure Horizon* measure potentially broadens researchers' ability to evaluate the nature of various types of corporate disclosures. For example, one interesting corporate disclosure to examine in the future may be conference presentations (Bushee, Jung, and Miller 2011). In these conference presentations, managers usually disclose information about the long-run strategy of the business to build a loyal "dedicated" investor base. *Disclosure Horizon* would measure the relative amount of long-run information provided during these presentations, which is an interesting dimension of disclosure that has been largely unexplored by prior research.

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Figure 1: Horizon of the S&P 500 (SPX)

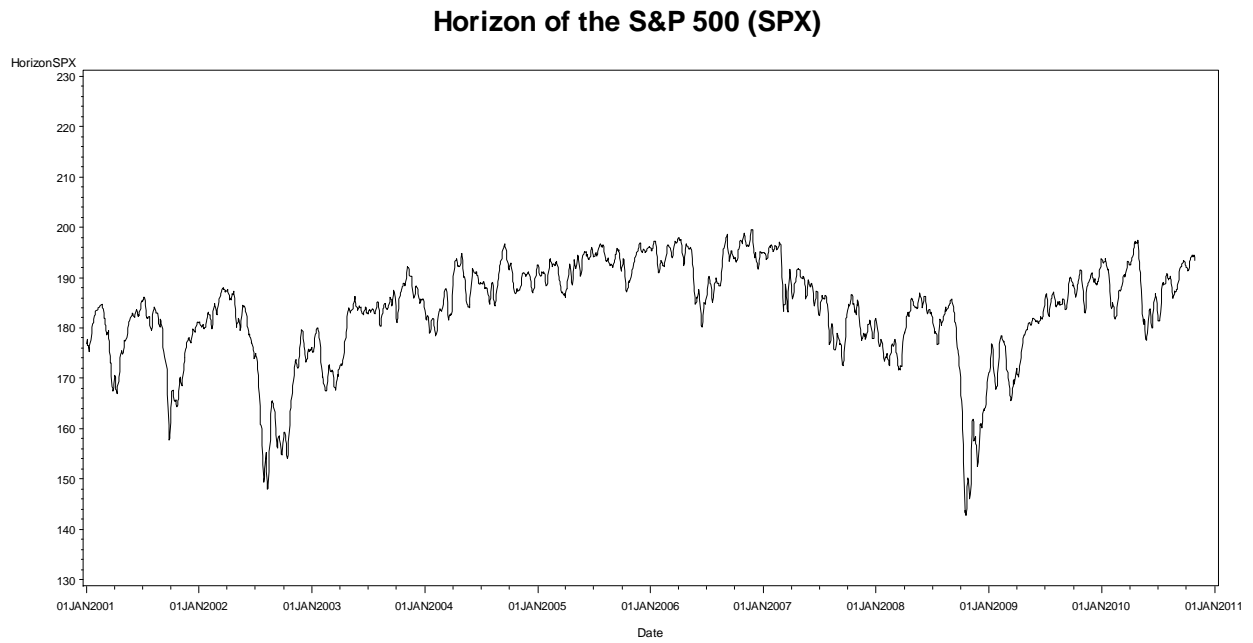


Table 1
Sample Description

Year	Number of firm-years	In S&P 500 index	Number of firm-quarters
2001	288	70%	929
2002	335	71%	1,127
2003	450	68%	1,508
2004	538	62%	1,875
2005	647	54%	2,151
2006	771	47%	2,599
2007	933	41%	3,031
2008	941	41%	3,166
2009	579	59%	2,025
2010	545	63%	1,562
Total	6,027	54%	19,973

This table presents the number of firms, the percentage of these firms in the S&P 500 index, and the number of firm-quarters in our sample by year. Firms must have implied volatilities on standardized options from OptionMetrics for all of the following durations: 30, 91, 182, 273, and 365 days. Firms must also have stock market data on CRSP and financial statement data on Compustat. The sample period is from January 2001 through October 2010. There are 1,297 unique firms in this sample.

Table 2
Descriptive Statistics

Variable	N	Mean	Std. Dev.	25 th	Median	75 th
<i>Horizon</i>	19,973	178.10	11.49	172.19	179.17	185.12
<i>Ln(Assets)</i>	19,973	8.66	1.84	7.48	8.62	9.90
<i>Ln(MB)</i>	19,973	1.00	0.85	0.48	0.96	1.47
<i>R&D</i>	19,973	0.043	0.083	0	0	0.06
<i>R&D Ind</i>	19,973	0.49	0.50	0	0	1
<i>CapEx</i>	19,973	0.013	0.019	0.003	0.008	0.016
<i>Loss</i>	19,973	0.19	0.39	0	0	0
<i>Horizon_{SPX}</i>	19,973	184.61	8.84	180.65	185.72	191.54
<i>PDC_{Short}</i>	19,973	0.37	0.48	0	0	1
<i>PDC_{Long}</i>	19,973	0.25	0.43	0	0	0
σ_{365}	19,973	0.44	0.25	0.27	0.37	0.53
<i>Ln(OpInt)</i>	19,973	11.03	1.45	10.10	11.03	11.97
<i>Ln(Vol)</i>	19,973	6.81	2.15	5.44	6.97	8.33
<i>StOpInt</i>	19,973	0.79	0.17	0.71	0.84	0.92
<i>StVol</i>	19,973	0.91	0.17	0.90	0.98	1.00
<i>#Analyst_{St}</i>	12,871	21.81	15.58	11.00	18.00	28.00
<i>#Analyst_{Lt}</i>	12,871	19.64	14.00	10.00	16.00	25.00
<i>AnalystTermSt</i>	12,871	1.93	1.74	0.98	1.48	2.32

This table presents descriptive statistics for the firm-quarters in our sample and for the S&P 500 index option (SPX). *Horizon* is equal to a firm's volatility-weighted duration. We measure *Horizon* 45 days after an earnings announcement. *Ln(Assets)* is equal to the natural logarithm of the firm's most recent quarter's total assets. *Ln(MB)* is equal to the natural logarithm of the firm's market-to-book ratio, which is the firm's current (45 days after the earnings announcement) market value divided by the firm's most recent quarter's book value of shareholder's equity. *R&D* is equal to the sum of the firm's R&D expense for the prior four quarters divided by the most recent quarter's total assets. *R&D Ind* is equal to one if R&D is greater than zero, and zero otherwise. *CapEx* is equal to the sum of the firm's capital expenditures for the prior four quarters divided by the most recent quarter's total assets. *Loss* is equal to one if the firm's most recent quarter's income before extraordinary items is less than zero, and zero otherwise. *Horizon_{SPX}* is equal to the volatility-weighted duration for the S&P 500 index option (SPX), measured on the same days as *Horizon*. *PDC_{Short}* (*PDC_{Long}*) is equal to one if the firm's industry is classified as having a short (long) product development cycle in Bushman et al. (1996), and zero otherwise. σ_{365} is the standard deviation of the firm's daily returns over the previous 365 calendar days. *Ln(OpInt)* is equal to the natural logarithm of the total open interest of all exchange traded options for that firm. *Ln(Vol)* is equal to the natural logarithm of the total volume of all exchange traded options for that firm. *StOpInt* is equal to the proportion of the total open interest in exchange traded options with less than nine months to expiration. *StVol* is equal to the proportion of the total volume in exchange traded options with less than nine months to expiration. We measure *Ln(OpInt)*, *Ln(Vol)*, *StOpInt*, and *StVol* on the same day as *Horizon*. *#Analyst_{St}* is equal to the number of analyst forecasts made during the current quarter for the firm's current fiscal year earnings. *#Analyst_{Lt}* is equal to the number of analyst forecasts made during the current quarter for the firm's next fiscal year earnings. *AnalystTermSt* is equal to the standard deviation of analyst estimates for the firm's next fiscal year's earnings scaled by the median estimate for the next fiscal year divided by the standard deviation of analyst estimates for the firm's current fiscal year's earnings scaled by the median estimate for the current fiscal year.

Table 3
Pearson and Spearman Correlation Coefficients

Variable	<i>Horizon</i>	<i>Ln</i> (<i>Assets</i>)	<i>Ln</i> (<i>MB</i>)	<i>R&D</i>	<i>R&D</i> <i>Ind</i>	<i>Cap</i> <i>Ex</i>	<i>Loss</i>	<i>Horizon</i> <i>SPX</i>	<i>PDC</i> <i>Short</i>	<i>PDC</i> <i>Long</i>	σ_{365}	<i>Ln</i> (<i>OpInt</i>)	<i>Ln</i> (<i>Vol</i>)	<i>St</i> <i>OpInt</i>	<i>St</i> <i>Vol</i>	<i>#Analyst</i> <i>St</i>	<i>#Analyst</i> <i>Lt</i>	<i>Analyst</i> <i>Term</i> <i>Str</i>
<i>Horizon</i>	1.00	0.18	0.08	-0.02	0.01 ^(c)	-0.08	-0.10	0.30	-0.08	-0.00 ^(c)	-0.26	-0.01 ^(b)	-0.05	-0.13	-0.08	-0.06	-0.06	0.03
<i>Ln(Assets)</i>	0.21	1.00	-0.23	-0.43	-0.30	-0.11	-0.22	0.00 ^(c)	-0.18	-0.02	-0.26	0.53	0.42	-0.10	-0.01 ^(c)	0.28	0.28	-0.03
<i>Ln(MB)</i>	0.07	-0.21	1.00	0.26	0.25	0.05	-0.15	0.13	0.01 ^(c)	0.05	-0.23	0.04	0.09	0.05	0.05	-0.03	-0.00 ^(c)	0.07
<i>R&D</i>	-0.02	-0.38	0.31	1.00	0.53	-0.09	0.30	-0.02 ^(a)	0.05	0.19	0.17	-0.02	-0.02 ^(a)	0.03	-0.03	-0.05	-0.03	0.09
<i>R&D Ind</i>	0.01 ^(c)	-0.29	0.29	0.93	1.00	-0.11	0.10	-0.02	0.12	0.10	0.07	0.05	0.05	0.01 ^(c)	-0.01 ^(c)	-0.07	-0.04	0.01 ^(b)
<i>CapEx</i>	-0.07	-0.13	0.16	-0.07	-0.03	1.00	-0.01 ^(a)	-0.05	-0.00 ^(c)	0.21	0.05	0.01 ^(c)	0.05	0.00 ^(c)	0.01 ^(a)	0.21	0.20	0.00 ^(c)
<i>Loss</i>	-0.10	-0.20	-0.16	0.17	0.10	-0.07	1.00	-0.07	-0.01 ^(b)	0.11	0.40	-0.02 ^(a)	-0.05	-0.07	-0.08	-0.08	-0.10	0.01 ^(c)
<i>Horizon_{SPX}</i>	0.27	0.00 ^(c)	0.11	-0.02	-0.02	-0.04	-0.08	1.00	-0.01 ^(c)	-0.01 ^(c)	-0.32	-0.01 ^(c)	-0.02	0.01 ^(c)	-0.01 ^(b)	-0.02	-0.05	-0.03
<i>PDC_{Short}</i>	-0.09	-0.21	0.02	0.15	0.12	0.06	-0.01 ^(b)	-0.01 ^(c)	1.00	-0.44	0.12	0.04	0.06	0.04	0.02	0.11	0.09	-0.08
<i>PDC_{Long}</i>	0.00 ^(c)	0.02 ^(a)	0.05	0.12	0.10	0.21	0.11	-0.01 ^(c)	-0.44	1.00	-0.00 ^(c)	0.06	0.06	-0.03	-0.01 ^(a)	0.11	0.11	0.06
σ_{365}	-0.32	-0.39	-0.17	0.18	0.12	0.02	0.37	-0.35	0.18	0.00 ^(c)	1.00	0.06	0.09	0.06	0.01 ^(c)	0.05	0.03	-0.02
<i>Ln(OpInt)</i>	-0.01 ^(b)	0.52	0.07	0.03	0.04	0.03	-0.01 ^(c)	-0.00 ^(c)	0.03	0.07	0.04	1.00	0.81	-0.06	-0.01 ^(c)	0.43	0.44	-0.03
<i>Ln(Vol)</i>	-0.05	0.41	0.12	0.04	0.05	0.06	-0.05	-0.02	0.05	0.06	0.07	0.81	1.00	0.03	0.07	0.43	0.44	-0.03
<i>StOpInt</i>	-0.14	-0.14	0.03	0.00 ^(c)	-0.01 ^(c)	-0.02	-0.05	-0.01 ^(c)	0.04	-0.03	0.09	-0.08	-0.01 ^(a)	1.00	0.33	0.03	0.04	0.05
<i>StVol</i>	-0.09	-0.19	-0.01 ^(c)	-0.02	-0.03	-0.02	-0.04	-0.02 ^(a)	0.02	-0.04	0.01 ^(c)	-0.31	-0.23	0.38	1.00	0.05	0.06	-0.01 ^(c)
<i>#Analyst_{St}</i>	-0.05	0.32	-0.01 ^(c)	-0.02	-0.04	0.13	-0.10	-0.01 ^(c)	0.11	0.09	0.05	0.48	0.47	0.00 ^(c)	-0.11	1.00	0.94	-0.12
<i>#Analyst_{Lt}</i>	-0.05	0.32	0.03	-0.01 ^(c)	-0.02	0.13	-0.12	-0.03	0.09	0.08	0.03	0.48	0.48	0.02 ^(b)	-0.11	0.92	1.00	-0.06
<i>Analyst</i> <i>Term</i> <i>Str</i>	0.03	0.01 ^(c)	0.10	-0.01 ^(c)	-0.02 ^(a)	0.03	-0.06	-0.01 ^(c)	-0.07	0.08	-0.06	-0.01 ^(c)	-0.01 ^(c)	0.07	0.01 ^(c)	-0.09	-0.02	1.00

(a) Correlation coefficient is significant at the 5% level; (b) Correlation coefficient is significant at the 10% level; (c) Correlation coefficient is not significant at the 10% level

This table presents Pearson (Spearman) correlation coefficients above (below) the diagonal. *Horizon* is equal to a firm's volatility-weighted duration. We measure *Horizon* 45 days after an earnings announcement. *Ln(Assets)* is equal to the natural logarithm of the firm's most recent quarter's total assets. *Ln(MB)* is equal to the natural logarithm of the firm's market-to-book ratio, which is the firm's current (45 days after the earnings announcement) market value divided by the firm's most recent quarter's book value of shareholder's equity. *R&D* is equal to the sum of the firm's R&D expense for the prior four quarters divided by the most recent quarter's total assets. *R&D Ind* is equal to one if R&D is greater than zero, and zero otherwise. *CapEx* is equal to the sum of the firm's capital expenditures for the prior four quarters divided by the most recent quarter's total assets. *Loss* is equal to one if the firm's most recent quarter's income before extraordinary items is less than zero, and zero otherwise. *Horizon_{SPX}* is equal to the volatility-weighted duration for the S&P 500 index option (SPX), measured on the same days as *Horizon*. *PDC_{Short}* (*PDC_{Long}*) is equal to one if the firm's industry is classified as having a short (long) product development cycle in Bushman et al. (1996), and zero otherwise. σ_{365} is the standard deviation of the firm's daily returns over the previous 365 calendar days. *Ln(OpInt)* is equal to the natural logarithm of the total open interest of all exchange traded options for that firm. *Ln(Vol)* is equal to the natural logarithm of the total volume of all exchange traded options for that firm. *StOpInt* is equal to the proportion of the total open interest in exchange traded options with less than nine months to expiration. *StVol* is equal to the proportion of the total volume in exchange traded options with less than nine months to expiration. We measure *Ln(OpInt)*, *Ln(Vol)*, *StOpInt*, and *StVol* on the same day as *Horizon*. *#Analyst_{St}* is equal to the number of analyst forecasts made during the current quarter for the firm's current fiscal year earnings. *#Analyst_{Lt}* is equal to the number of analyst forecasts made during the current quarter for the firm's next fiscal year earnings. *AnalystTermStr* is equal to the standard deviation of analyst estimates for the firm's next fiscal year's earnings scaled by the median estimate for the next fiscal year divided by the standard deviation of analyst estimates for the firm's current fiscal year's earnings scaled by the median estimate for the current fiscal year. All correlation coefficients are significant at the 1% level, unless noted otherwise.

Table 4
Regression Analysis of *Horizon*

Variable	Predicted Sign	(1)	(2)	(3)	(4)
<i>Ln(Assets)</i>	+	0.96 (7.08)	1.02 (6.42)	1.89 (9.96)	1.32 (6.17)
<i>Ln(MB)</i>	+	0.76 (3.26)	0.71 (2.89)	1.40 (6.40)	0.75 (3.24)
<i>R&D Ind</i>	+	1.27 (3.09)			
<i>R&D</i>	+		9.49 (3.86)	15.13 (8.44)	14.96 (8.83)
<i>CapEx</i>		-18.64 (-2.39)	-17.43 (-1.90)	-4.13 (-0.48)	-3.24 (-0.40)
<i>Loss</i>	-	-1.16 (-2.41)	-1.53 (-4.11)	-1.48 (-4.67)	-0.35 (-0.90)
<i>Horizon_{SPX}</i>	+	0.37 (4.66)	0.37 (4.72)	0.38 (5.90)	0.38 (5.86)
<i>PDC_{Short}</i>	-	-1.73 (-2.78)	-1.67 (-2.71)	-0.57 (-1.05)	-0.62 (-1.36)
<i>PDC_{Long}</i>	+	-0.77 (-1.16)	-0.90 (-1.26)	-0.46 (-0.85)	-0.71 (-1.54)
<i>Ln(OpInt)</i>				-0.93 (-5.18)	-0.62 (-3.87)
<i>Ln(Vol)</i>				-0.54 (-5.71)	-0.45 (-4.40)
<i>StOpInt</i>	-			-7.30 (-4.58)	-7.29 (-4.63)
<i>StVol</i>	-			-2.82 (-4.81)	-2.85 (-5.02)
σ_{365}	-				-8.81 (-4.04)
Year-quarter fixed effects		Yes	Yes	Yes	Yes
Adj. R ²		.2053	.2060	.2422	0.2570
N		19,973	19,973	19,973	19,973
t-tests:					
$R\&D = CapEx$			(3.28)	(2.27)	(2.35)
$PDC_{Long} = PDC_{Short}$		(1.84)	(1.26)	(0.20)	(-0.19)

The dependent variable, *Horizon*, is equal to a firm's volatility-weighted duration measured 45 days after an earnings announcement. *Ln(Assets)* is equal to the natural logarithm of the firm's most recent quarter's total assets. *Ln(MB)* is equal to the natural logarithm of the firm's market-to-book ratio, which is the firm's current (45 days after the earnings announcement) market value divided by the firm's most recent quarter's book value of shareholder's equity. *R&D* is equal to the sum of the firm's R&D expense for the prior four quarters divided by the most recent quarter's total assets. *R&D Ind* is equal to one if R&D is greater than zero, and zero otherwise. *CapEx* is equal to the sum of the firm's capital expenditures for the prior four quarters divided by the most recent quarter's total assets. *Loss* is equal to one if the firm's most recent quarter's income before extraordinary items is less than zero, and zero otherwise. *Horizon_{SPX}* is equal to the volatility-weighted duration for the S&P 500 index option (SPX), measured on the same days as *Horizon*. *PDC_{Short}* (*PDC_{Long}*) is equal to one if the firm's industry is classified as having a short (long) product development cycle in Bushman et al. (1996), and zero otherwise. σ_{365} is the standard deviation of the firm's daily returns over the previous 365 calendar days. *Ln(OpInt)* is equal to the natural logarithm of the total open interest of all exchange traded options for that firm. *Ln(Vol)* is equal to the natural logarithm of the total volume of all exchange traded options for that firm. *StOpInt* is equal to the proportion of the total open interest in exchange traded options with less than nine months to expiration. *StVol* is equal to the proportion of the total volume in exchange traded options with less than nine months to expiration. We measure *Ln(OpInt)*, *Ln(Vol)*, *StOpInt*, and *StVol* on the same day as *Horizon*. t-statistics are presented in parentheses and calculated based on two-way (by 2-digit SIC code and year-quarter) cluster-robust standard errors.

Table 5
Regression Analysis of the Term Structure of the Dispersion in Analysts' Earnings Forecasts

Variable	Predicted Sign	(1)	(2)
<i>Ln(Assets)</i>	+	-0.01 (-0.21)	
<i>Ln(MB)</i>	+	0.07 (1.54)	
<i>R&D</i>	+	1.88 (2.79)	
<i>CapEx</i>		1.21 (1.69)	
<i>Loss</i>	-	-0.01 (-0.13)	
<i>Horizon_{SPX}</i>	+	0.01 (1.52)	0.41 (5.58)
<i>PDC_{Short}</i>	-	-0.28 (-3.67)	
<i>PDC_{Long}</i>	+	0.00 (0.03)	
σ_{365}	-	-0.39 (-2.11)	
<i>AnalystTermSt</i>	+		0.24 (2.72)
<i>#Analyst_{St}</i>	-		-0.08 (-2.42)
<i>#Analyst_{t,t}</i>	+		0.05 (1.69)
<i>Ln(OpInt)</i>		-0.04 (-1.32)	0.49 (2.06)
<i>Ln(Vol)</i>		0.02 (1.47)	-0.46 (-3.96)
<i>StOpInt</i>	-	0.12 (1.21)	-7.83 (-4.85)
<i>StVol</i>	-	-0.19 (-1.56)	-2.66 (-3.35)
Year-quarter fixed effects		Yes	Yes
Adj. R ²		0.0531	.1912
N		12,871	12,871

The dependent variable in (1), *AnalystTermSt*, is equal to the standard deviation of analyst estimates for the firm's next fiscal year's earnings scaled by the median estimate for the next fiscal year divided by the standard deviation of analyst estimates for the firm's current fiscal year's earnings scaled by the median estimate for the current fiscal year. The dependent variable in (2), *Horizon*, is equal to a firm's volatility-weighted duration measured 45 days after an earnings announcement. *Ln(Assets)* is equal to the natural logarithm of the firm's most recent quarter's total assets. *Ln(MB)* is equal to the natural logarithm of the firm's market-to-book ratio, which is the firm's current (45 days after the earnings announcement) market value divided by the firm's most recent quarter's book value of shareholder's equity. *R&D* is equal to the sum of the firm's R&D expense for the prior four quarters divided by the most recent quarter's total assets. *R&D Ind* is equal to one if R&D is greater than zero, and zero otherwise. *CapEx* is equal to the sum of the firm's capital expenditures for the prior four quarters divided by the most recent quarter's total assets. *Loss* is equal to one if the firm's most recent quarter's income before extraordinary items is less than zero, and zero otherwise. *Horizon_{SPX}* is equal to the volatility-weighted duration for the S&P 500 index option (SPX), measured on the same days as *Horizon*. *PDC_{Short}* (*PDC_{Long}*) is equal to one if the firm's industry is classified as having a short (long) product development cycle in Bushman et al. (1996), and zero otherwise. σ_{365} is the standard deviation of the firm's daily returns over the previous 365 calendar days. *Ln(OpInt)* is equal to the natural logarithm of the total open interest of all exchange traded options for that firm. *Ln(Vol)* is equal to the natural logarithm of the total volume of all exchange traded options for that firm. *StOpInt* is equal to the proportion of the total open interest in exchange traded options with less than nine months to expiration. *StVol* is equal to the proportion of the total volume in exchange traded options with less than nine months to expiration. *#Analyst_{St}* is equal to the number of analyst forecasts made during the current quarter for the firm's current fiscal year earnings. *#Analyst_{t,t}* is equal to the number of analyst forecasts made during the current quarter for the firm's next fiscal year earnings. t-statistics are presented in parentheses and calculated based on two-way (by 2-digit SIC code and year-quarter) cluster-robust standard errors.

Table 6
Descriptive Statistics at Earnings Announcement Dates

Variable	N	Mean	Std. Dev.	25 th	Median	75 th
Panel A: Conference Call Subsample						
<i>Disclosure Horizon</i>	14,973	180.45	45.09	148.30	179.84	211.09
<i>Disclosure Horizon_{SPX}</i>	14,973	153.84	34.30	130.27	151.94	173.24
<i>Horizon_{pre}</i>	14,973	178.60	12.94	172.61	180.16	186.04
<i>Horizon_{pre,SPX}</i>	14,973	184.70	8.00	181.19	185.65	190.63
<i>OpenInt</i>	14,973	10.82	1.51	9.80	10.83	11.82
<i>StOpenInt</i>	14,973	-0.28	0.31	-0.36	-0.18	-0.09
<i>AnnRet</i>	14,973	0.001	0.074	-0.031	0.002	0.035
<i>AnnRet</i> ²	14,973	0.006	0.018	0.000	0.001	0.004
<i>Forecast Horizon</i>	6,271	4.84	0.77	4.25	5.04	5.48
<i>Bundled</i>	14,973	0.42	0.49	0	0	1
<i>Conf. Call</i>	14,973	0.24	0.42	0	0	0
<i>Bundled*Conf. Call</i>	14,973	0.12	0.32	0	0	0
Panel B: Full Sample						
<i>Disclosure Horizon</i>	19,564	180.16	44.74	148.46	179.22	210.43
<i>Disclosure Horizon_{SPX}</i>	19,564	155.00	33.52	133.41	154.19	173.76
<i>Horizon_{pre}</i>	19,564	178.95	12.49	173.15	180.34	186.08
<i>Horizon_{pre,SPX}</i>	19,564	184.29	7.62	180.83	184.80	189.89
<i>OpenInt</i>	19,564	10.96	1.45	10.04	10.97	11.90
<i>StOpenInt</i>	19,564	-0.26	0.29	-0.33	-0.16	-0.07
<i>AnnRet</i>	19,564	0.002	0.078	-0.033	0.001	0.005
<i>AnnRet</i> ²	19,564	0.006	0.021	0.000	0.001	0.005
<i>Forecast Horizon</i>	7,861	4.83	0.79	4.23	5.03	5.48
<i>Bundled</i>	19,564	0.40	0.49	0	0	1

This table presents descriptive statistics for the sample of earnings announcements in the conference call subsample (2002 - 2008; Panel A) and in the full sample of earnings announcements (2001 - October 2010; Panel B). *Disclosure Horizon* is the firm's volatility-change-weighted duration over a three-day window centered on the firm's earnings announcement date. *Disclosure Horizon_{SPX}* is equal to the volatility-change-weighted duration for the S&P 500 index option (SPX), over the same three-day windows as the firms. *Horizon_{pre}* is the firm's volatility-weighted duration two days prior to the earnings announcement. *Horizon_{pre,SPX}* is the SPX's volatility-weighted duration two days prior to the earnings announcement. The implied volatility for the first 30 days is excluded from the calculation of *Disclosure Horizon*, *Disclosure Horizon_{SPX}*, *Horizon_{pre}*, and *Horizon_{pre,SPX}*. *OpenInt* is equal to the natural logarithm of the total open interest prior to the earnings announcement window of all exchange traded options for that firm. *StOpenInt* is equal to the natural logarithm of the proportion of the total open interest prior to the earnings announcement window in exchange traded options with less than nine months to expiration. *AnnRet* is equal to the firm's compounded three-day stock return during the earnings announcement window. *AnnRet*² is equal to *AnnRet* squared. *Forecast Horizon* is equal to the natural logarithm of the average of all the EPS forecast horizons that a firm bundled with an earnings announcement. *Forecast Horizon* is only calculated for earnings announcements that contained a management forecast of EPS. Each individual forecast horizon is equal to the difference between the end of the fiscal period being forecasted and the forecast date. *Bundled* is equal to one if the firm issued an EPS forecast within a three day window around their earnings announcement date, and zero otherwise. *Conf. Call* is equal to one if the firm held a conference call within a three day window around their earnings announcement date, and zero otherwise. *Bundled*Conf. Call* is equal to one if the firm both issued an EPS forecast and held a conference call within a three day window around their earnings announcement, and zero otherwise.

Table 7
Pearson and Spearman Correlation Coefficients at Earnings Announcement Dates

Variable	<i>Disclosure Horizon</i>	<i>Disclosure Horizon_{SPX}</i>	<i>Horizon_{pre}</i>	<i>Horizon_{pre,SPX}</i>	<i>OpenInt</i>	<i>St OpenInt</i>	<i>Ann Ret</i>	<i>Ann Ret²</i>	<i>Forecast Horizon</i>	<i>Bundled</i>	<i>Conf. Call</i>	<i>Bundled* Conf. Call</i>
<i>Disclosure Horizon</i>	1.00	-0.02 ^(b)	-0.26	-0.13	-0.03	0.06	0.01 ^(b)	0.03	0.00 ^(c)	-0.03	-0.02 ^(a)	-0.01 ^(c)
<i>Disclosure Horizon_{SPX}</i>	-0.01 ^(c)	1.00	0.03	0.02	-0.01 ^(c)	0.02 ^(a)	-0.02 ^(a)	-0.02	0.04	0.01 ^(c)	0.04	0.03
<i>Horizon_{pre}</i>	-0.22	0.02	1.00	0.28	-0.07	-0.11	0.01 ^(b)	-0.11	0.08	0.04	0.07	0.08
<i>Horizon_{pre,SPX}</i>	-0.11	0.01 ^(c)	0.21	1.00	-0.01 ^(c)	-0.02	0.02 ^(a)	-0.17	0.08	-0.00 ^(c)	0.07	0.04
<i>OpenInt</i>	-0.04	-0.00 ^(c)	-0.07	-0.01 ^(c)	1.00	-0.07	-0.01 ^(c)	-0.00 ^(c)	-0.04	-0.03	0.10	0.05
<i>StOpenInt</i>	0.05	0.03	-0.11	-0.01 ^(c)	-0.14	1.00	-0.02 ^(b)	0.01 ^(c)	0.02 ^(b)	0.02	-0.03	-0.01 ^(c)
<i>AnnRet</i>	0.01 ^(c)	-0.03	0.02 ^(a)	0.01 ^(b)	-0.01 ^(c)	-0.03	1.00	0.01 ^(b)	0.02 ^(b)	0.00	0.02 ^(a)	0.00 ^(c)
<i>AnnRet²</i>	0.05	-0.02 ^(b)	-0.17	-0.18	-0.00 ^(c)	0.01 ^(c)	0.03	1.00	-0.02 ^(b)	-0.11	-0.05	-0.06
<i>Forecast Horizon</i>	-0.01 ^(c)	0.03 ^(a)	-0.10	0.07	-0.02 ^(b)	0.04	0.03 ^(a)	-0.06	1.00	N/A	0.01 ^(c)	0.01 ^(c)
<i>Bundled</i>	-0.03	0.00 ^(c)	0.05	0.00 ^(c)	-0.03	0.03	0.01 ^(c)	-0.16	N/A	1.00	0.10	0.43
<i>Conf. Call</i>	-0.02 ^(a)	0.04	0.07	0.06	0.09	-0.05	0.02	-0.05	0.02 ^(b)	0.10	1.00	0.67
<i>Bundled*Conf. Call</i>	-0.01 ^(c)	0.02	0.09	0.03	0.04	-0.03	0.01 ^(c)	-0.09	0.02 ^(b)	0.43	0.67	1.00

(a) Correlation coefficient is significant at the 5% level; (b) Correlation coefficient is significant at the 10% level; (c) Correlation coefficient is not significant at the 10% level

This table presents Pearson (Spearman) correlation coefficients above (below) the diagonal. *Disclosure Horizon* is the firm's volatility-change-weighted duration over a three-day window centered on the firm's earnings announcement date. *Disclosure Horizon_{SPX}* is equal to the volatility-change-weighted duration for the S&P 500 index option (SPX), over the same three-day windows as the firms. *Horizon_{pre}* is the firm's volatility-weighted duration two days prior to the earnings announcement. *Horizon_{pre,SPX}* is the SPX's volatility-weighted duration two days prior to the earnings announcement. The implied volatility for the first 30 days is excluded from the calculation of *Disclosure Horizon*, *Disclosure Horizon_{SPX}*, *Horizon_{pre}*, and *Horizon_{pre,SPX}*. *OpenInt* is equal to the natural logarithm of the total open interest prior to the earnings announcement window of all exchange traded options for that firm. *StOpenInt* is equal to the natural logarithm of the proportion of the total open interest prior to the earnings announcement window in exchange traded options with less than nine months to expiration. *AnnRet* is equal to the firm's compounded three-day stock return during the earnings announcement window. *AnnRet²* is equal to *AnnRet* squared. *Forecast Horizon* is equal to the natural logarithm of the average of all the EPS forecast horizons that a firm bundled with an earnings announcement. *Forecast Horizon* is only calculated for earnings announcements that contained a management forecast of EPS. Each individual forecast horizon is equal to the difference between the end of the fiscal period being forecasted and the forecast date. *Bundled* is equal to one if the firm issued an EPS forecast within a three day window around their earnings announcement date, and zero otherwise. *Conf. Call* is equal to one if the firm held a conference call within a three day window around their earnings announcement date, and zero otherwise. *Bundled*Conf. Call* is equal to one if the firm both issued an EPS forecast and held a conference call within a three day window around their earnings announcement, and zero otherwise. All correlation coefficients are significant at the 1% level, unless noted otherwise.

Table 8
Regression Analysis of *Disclosure Horizon*

Variable	Predicted Sign	(1)	(2)	(3)
<i>Forecast Horizon</i>	+	1.46 (1.84)		
<i>Bundled</i>			-2.97 (-3.09)	-4.27 (-3.80)
<i>Conf. Call</i>		3.33 (2.21)		-1.99 (-1.72)
<i>Bundled*Conf. Call</i>				5.18 (2.71)
<i>Horizon_{pre}</i>	-	-0.87 (-7.83)	-0.77 (-9.55)	-0.77 (-9.63)
<i>Horizon_{pre,SPX}</i>		-0.54 (-1.51)	-0.49 (-2.26)	-0.50 (-2.26)
<i>Disclosure Horizon_{SPX}</i>		0.01 (0.47)	0.01 (0.64)	0.01 (0.63)
<i>AnnRet</i>	+	3.76 (0.38)	14.03 (1.98)	14.19 (2.01)
<i>AnnRet</i> ²	-	-36.37 (-0.59)	-33.17 (-1.90)	-34.25 (-1.93)
Year-quarter fixed effects		Yes	Yes	Yes
Adj. R ²		0.1200	0.1116	0.1122
N		6,271	14,973	14,973

The dependent variable, *Disclosure Horizon*, is equal to a firm's volatility-change-weighted duration over a three-day window centered on the firm's earnings announcement date. *Forecast Horizon* is equal to the natural logarithm of the average of all the EPS forecast horizons that a firm bundled with an earnings announcement. *Forecast Horizon* is only calculated for earnings announcements that contained a management forecast of EPS. Each individual forecast horizon is equal to the difference between the end of the fiscal period being forecasted and the forecast date. *Bundled* is equal to one if the firm issued an EPS forecast within a three day window around their earnings announcement date, and zero otherwise. *Conf. Call* is equal to one if the firm held a conference call within a three day window around their earnings announcement date, and zero otherwise. *Bundled*Conf. Call* is equal to one if the firm both issued an EPS forecast and held a conference call within a three day window around their earnings announcement, and zero otherwise. *Horizon_{pre}* is the firm's volatility-weighted duration two days prior to the earnings announcement. *Horizon_{pre,SPX}* is the SPX's volatility-weighted duration two days prior to the earnings announcement. *Disclosure Horizon_{SPX}* is equal to the volatility-change-weighted duration for the S&P 500 index option (SPX), over the same three-day windows as the firms. The implied volatility for the first 30 days is excluded from the calculation of *Disclosure Horizon*, *Disclosure Horizon_{SPX}*, *Horizon_{pre}*, and *Horizon_{pre,SPX}*. *AnnRet* is equal to the firm's compounded three-day stock return during the earnings announcement window. *AnnRet*² is equal to *AnnRet* squared. t-statistics are presented in parentheses and calculated based on two-way (by 2-digit SIC code and year-quarter) cluster-robust standard errors.

Table 9
Regression Analysis of Open Interest in Short-term Options

Variable	Predicted Sign	(1)	(2)
<i>Forecast Horizon</i>	-	-0.0138 (-2.52)	
<i>Bundled</i>	+		0.0084 (1.84)
<i>Horizon_{pre}</i>	-	-0.0013 (-3.39)	-0.0015 (-4.65)
<i>Horizon_{pre,SPX}</i>		0.0019 (0.57)	0.0013 (0.30)
<i>OpenInt</i>	-	-0.0147 (-3.10)	-0.0154 (-3.85)
Year-quarter fixed effects		Yes	Yes
Adj. R ²		0.2489	0.2324
N		7,861	19,564

The dependent variable, *StOpenInt*, is equal to the natural logarithm of the proportion of the total open interest prior to the earnings announcement window in exchange traded options with less than nine months to expiration. *Forecast Horizon* is equal to the natural logarithm of the average of all the EPS forecast horizons that a firm bundled with an earnings announcement. *Forecast Horizon* is only calculated for earnings announcements that contained a management forecast of EPS. Each individual forecast horizon is equal to the difference between the end of the fiscal period being forecasted and the forecast date. *Bundled* is equal to one if the firm issued an EPS forecast within a three day window around their earnings announcement date, and zero otherwise. *Horizon_{pre}* is the firm's volatility-weighted duration two days prior to the earnings announcement. *Horizon_{pre,SPX}* is the SPX's volatility-weighted duration two days prior to the earnings announcement. *OpenInt* is equal to the natural logarithm of the total open interest prior to the earnings announcement window of all exchange traded options for that firm. The implied volatility for the first 30 days is excluded from the calculation of *Horizon_{pre}*, and *Horizon_{pre,SPX}*. t-statistics are presented in parentheses and calculated based on two way (by 2-digit SIC code and year-quarter) cluster-robust standard errors.