ABSTRACT

Title of Dissertation: BEYOND RISK: VOLUNTARY DISCLOSURE UNDER AMBIGUITY

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Dissertation directed by: Professor Emanuel Zur, Accounting and Information Assurance

In my dissertation, I examine the impact of ambiguity (Knightian uncertainty), alongside that of risk, on firms' voluntary disclosure decisions. I confirm the well-known result that an increase in risk—uncertainty over outcomes—is associated with an increase in management guidance (earnings and capital expenditure forecasts). Conversely, I find that an increase in ambiguity—uncertainty over the probabilities of outcomes—is associated with less guidance. Furthermore, I show that ambiguity decreases following voluntary disclosures, consistent with managers being aware of and reacting to heightened ambiguity. Finally, I provide novel empirical evidence showing that guidance under ambiguity has adverse capital market consequences. Even though the ways through which risk impacts managers' disclosure decisions have been extensively studied in the accounting literature, no extant research has examined whether and how ambiguity impacts these decisions. My findings are consistent with the notion that managers' take into account the ambiguity in the environment, showing that ambiguity has an important and distinct impact on their voluntary disclosure decisions.

BEYOND RISK: VOLUNTARY DISCLOSURE UNDER AMBIGUITY

by

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Dedication

To the women of my life: the one who birthed me, the one who helped raise me, and the who helped shape me into the person I am today.

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"There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. There are things we don't know we don't know."
- Secretary Donald Rumsfeld

Chapter 1: Introduction

Ambiguity, also known as Knightian uncertainty, is rooted in nearly every real-life decision process. It refers to situations under which both the *outcomes* and the *probabilities of those outcomes* are unknown (Knight, 1921; Keynes, 1921). Risk, on the other hand, typically treats the set of future outcomes as unknown, but with certain probabilities assigned to them.[1] Prior work in the voluntary disclosure literature has considered the role of risk alone by assuming away ambiguity or implicitly assuming that individuals are neutral to ambiguity. Yet, Ellsberg (1961) and others have shown that not only are people averse to both these aspects of uncertainty, but they also behave differently when confronted with ambiguity vis-à-vis risk.[2] Thus, ignoring ambiguity may result in an incomplete understanding of firms' disclosure decisions under uncertainty.

While many empirical studies (e.g., Rogers et al., 2009; Rogers and Van Buskirk, 2013; Billings et al., 2015) have focused on the effect of uncertainty on voluntary disclosure decisions, they have not considered ambiguity. In this paper, I introduce ambiguity in conjunction with risk to study voluntary disclosure decisions and empirically test how ambiguity, alongside risk, is associated with managers' disclosure decisions under this broader definition of uncertainty. In my tests, I extend prior empirical models of managers' voluntary disclosure decisions under uncertainty by including a novel measure of ambiguity. My tests provide strong empirical support

[1] Ambiguity is distinctly different from risk. Risk refers to conditions under which the set of events that may occur is *a priori* unknown, but the odds of these possible events are perfectly known. Ambiguity refers to conditions under which the set of events that may occur is *a priori* unknown and the odds of these possible events are also either not unique or unknown.

[2] See Epstein and Schneider (2010) for a full review of the history of ambiguity.

that ambiguity has an important impact on voluntary disclosure decisions that is distinct from the effect of risk.

The literature on voluntary disclosure has shown that during an abnormal increase in volatility, managers issue more earnings guidance and that this guidance reduces volatility (e.g., Rogers and Van Buskirk, 2013; Billings et al., 2015). I show that the association between voluntary earnings guidance and risk continues to hold after controlling for the presence of ambiguity. However, the effect of ambiguity on the provision of voluntary guidance differs markedly from that of risk: while an increase in risk is positively related with the decision to issue voluntary earnings guidance, an increase in ambiguity is negatively associated with the firms' decision to issue such guidance.

The impact of ambiguity on voluntary disclosure decisions highlights a key limitation in previous voluntary disclosure research—the assumption of a constant underlying distribution (e.g., Diamond, 1985; Dye, 1985; Diamond & Verrecchia, 1991; Lewellen and Shanken, 2002; Pastor and Veronesi, 2003). Theoretical models of the relationship between risk and voluntary disclosure have asserted that under a constant underlying distribution, by providing risk-averse investors with more information, managers increase the rate at which investors learn about the firms' economic fundamentals, causing a reduction in risk, which results in lower share price volatility (Brown, 1979). Conversely, an increase in ambiguity in the presence of both risk- and ambiguity-averse investors may cause the provision of more information to lead to an increase in share price volatility. This happens because higher ambiguity causes ambiguity-averse investors to assign more weight to the worst-case scenario (Izhakian and Yermack, 2017; Bailon et al., 2018; Augustin and Izhakian, 2020; Dangl and Weissensteiner, 2020; Illeditsch et al., 2021).[3] Such behavior by

[3] The extant literature views ambiguity aversion as rational behavior. See Epstein and Schinder (2010) for a further discussion. See also Gilboa and Schmeidler (1989) for axioms for the maxmin expected utility (MMEU) with

ambiguity-averse investors who possess different types of information may lead to higher price fluctuations as a reaction to forecast news during high ambiguity periods (Epstein and Schneider, 2008).[4] Furthermore, small cash-flow news may cause a sudden change in ambiguity-averse investors' worst-case scenario beliefs, amplifying the effects of negative news shocks on stock prices, consequently leading to excess volatility again (Illeditsch, 2011).

Accounting for the presence of ambiguity-averse investors highlights a sharp distinction in the incentives to provide voluntary disclosure under the two aspects of uncertainty—ambiguity and risk. In this framework, an increase in risk is associated with providing more information, while an increase in ambiguity is expected to be associated with a decreased willingness to provide new information. When risk increases, firms are incentivized to share more information, since investors become more certain about future outcomes as more information is provided, which reduces volatility. The intuition for why increased ambiguity results in lower voluntary disclosure is similar. Greater ambiguity causes ambiguity-averse investors to overweight the perceived probabilities of future bad states, leading to higher price volatility when news is presented (Epstein and Schneider, 2008; Caskey, 2009; Illeditsch, 2011). This pessimistic view of the future is greater when ambiguity increases. It is also worth noting that executives should be especially worried about ambiguity-averse investors, since high share price volatility may lead to terminal career repercussions (e.g., Engel et al., 2003; Bushman et al., 2010; Jenter and Lewellen, 2021), lawsuits (e.g., Kim and Skinner, 2012), and unfavorable capital market outcomes (e.g., Chordia et al., 2005).

the multiple priors framework and the Choquet expected utility (CEU) framework and Izhakian (2017) for axioms for the expected utility under the unexpected probabilities (EUUP) framework.

[4] More precisely, the Epstein and Schneider (2008) model showed that when ambiguity is high, ambiguity-averse investors attach more weight to news than investors who know the "true" information. They further showed that this difference in reactions between the two types of investors may cause a spike in share price volatility.

Because both risk and ambiguity impact voluntary disclosure decisions, measuring ambiguity levels independently of the aversion to ambiguity, aversion to risk, and level of risk is a major challenge in empirically testing the hypotheses proposed in this paper. The empirical measure of ambiguity that I employ is based on a recent theoretical model and empirical estimation rooted in the decision theory framework of expected utility with uncertain probabilities (EUUP) (Izhakian, 2017, 2020). In this framework, preferences for ambiguity are applied directly to probabilities such that the attitude toward ambiguity is defined as an attitude toward mean-preserving spreads in probabilities. As such, the degree of ambiguity can be measured by the variance of probabilities, just as the degree of risk can be measured by the variance of outcomes. The measure of ambiguity considers the variation in the probabilities of events without incorporating the magnitudes of the outcomes associated with these events (outcome independence). By contrast, measures of risk consider the variation in the magnitudes of outcomes without incorporating the variation in the probabilities of associated events (outcome dependence).

This measure has been employed in recent capital markets and corporate finance research to examine issues such as early exercise of employee stock options (Izhakian and Yermack, 2017), risk, ambiguity, and uncertainty premiums (Brenner and Izhakian, 2018), and pricing of credit default swaps (Augustin and Izhakian, 2020). Previous studies have performed extensive testing, showing how this measure of ambiguity is unique in capturing a distinct dimension of uncertainty that is not related to risk by controlling for alternative well-known dimensions of uncertainty (Izhakian and Yermack, 2017; Brenner and Izhakian, 2018; Augustin and Izhakian, 2020). To alleviate any concern that my result might be influenced by other dimensions of uncertainty, my analysis also includes controls for risk and other factors that might capture uncertainty, such as the Chicago Board Options Exchange's Volatility Index (VIX) (Williams, 2015), economic policy

uncertainty (EPU) (Baker et al., 2016; Nagar et al., 2019) and disagreement among analysts (Anderson et al., 2009).

To test the hypothesis of a negative relationship between heightened ambiguity and firms' voluntary disclosure, I investigate how firms' issuance of earnings guidance (Rogers et al., 2009; Rogers and Van Buskirk, 2013; Billings et al., 2015; Bourveau and Schoenfeld, 2017; Bourveau et al., 2018; Maslar et al., 2021) and capital expenditure guidance (Jayaraman and Wu, 2020) is related to changes in ambiguity. I account for risk by controlling for implied volatility (Rogers et al., 2009; Rogers and Van Buskirk, 2013; Billings et al., 2015) and examine the extent to which changes in ambiguity are followed by changes in guidance in the subsequent quarter and in the propensity to issue a forecast with an earnings announcement (bundled forecasts). In each regression specification, the estimated coefficient on the change in ambiguity is negative and significant, consistent with what the theory predicts. The results are robust to including alterative uncertainty factors (e.g., VIX, EPU and disagreement among analysts) and controlling for earnings news and characteristics (Rogers and Van Buskirk, 2013) in the empirical model.

While on average heightened ambiguity is associated with reduced voluntary disclosure, if managers are ambiguity conscious, they are more likely to make disclosures in situations where the disclosure decreases, rather than increases, ambiguity. Theoretical and empirical evidence has indicated that managers are committed to disclosure to reduce investor uncertainty (e.g., Diamond, 1985; Dye, 1985; Diamond & Verrecchia, 1991; Lewellen and Shanken, 2002; Pastor and Veronesi, 2003, Billing et al., 2015;), especially to avoid terminal implications for executives' careers (e.g., Engel et al., 2003; Bushman et al., 2010; Jenter and Lewellen, 2021). Furthermore, real-world, empirical, and theoretical evidence has shown that managers are aware of ambiguity (Izhakian and Yermack, 2017; Bachmann et al., 2020) and may act to alleviate ambiguity-averse

investors' concerns (Epstein and Schneider, 2008; Caskey, 2009). Specifically, managers may adjust their disclosure in highly ambiguous periods to cater to ambiguity-averse investors. Hence, for firms that do make disclosures, one can expect that they do so only when disclosure is anticipated to decrease ambiguity.

To test these expectations, I then examine whether managers' decision to issue a bundled forecast reduces ambiguity. I investigate whether firms' issuance of bundled earnings and capital expenditure guidance is related to a resolution of ambiguity around earnings announcements. I account for the normal resolution of ambiguity and risk around earnings announcements, as well as the pre-forecast changes in ambiguity and risk (Rogers and Van Buskirk, 2013; Billings et al., 2015), and examine the extent to which bundled forecasts reduce ambiguity. In each regression specification, the estimated coefficient on providing a bundled forecast is negative and significant, consistent with managers taking ambiguity into consideration in their disclosure decisions.

In additional analysis, I provide further empirical evidence to strengthen the theoretical reasoning for the adverse capital market consequences that guiding under high ambiguity might have (Epstein and Schneider, 2008; Illeditsch, 2011). Consistent with theoretical predictions, when ambiguity is high, bad news forecasts are associated with increased volatility. When ambiguity is low, however, both bad and good news forecasts are associated with a reduction in volatility. In a similar vein, when ambiguity is high, the negative abnormal return of bad news forecast bundled with an earnings announcement is as much as three times the negative abnormal return of an earnings announcement with no forecast provided. Bundling good news during high ambiguity periods has an insignificant positive abnormal return.

As previously noted, the literature on voluntary disclosure under uncertainty is yet to take ambiguity into consideration. This somewhat simplistic view of firms' disclosure practices overly

relies on the influence of risk when investigating the effect of uncertainty (Rogers et al., 2009; Rogers and Van Buskirk, 2013; Balakrishnan et al., 2014; Billings et al., 2015; Nagar et al., 2019). My paper extends the literature by providing new insights into voluntary disclosure decisions in an uncertain environment. My results imply the average effect of ambiguity on voluntary disclosure to be opposite that of risk, showing a negative relationship between increases in ambiguity and management guidance.

The paper proceeds as follows. Section two establishes the conceptual framework. Section three describes the data sources and variable constructions. Section four describes the data. Section five investigates guidance under ambiguity. Section six concludes.

Chapter 2: Conceptual Framework

The notion of risk refers to situations where the odds of events are known, but the outcomes themselves are unknown and yet to manifest. Ambiguity, however, refers to conditions under which the set of events that may occur is *a priori* unknown and the odds of these possible events are also either non-distinct or unknown. Frank Knight is credited to be the first to introduce the notion of ambiguity, also known as Knightian uncertainty (Knight, 1921), claiming that to capture the complete effect of uncertainty, one must consider both risk and ambiguity. In this paper, I explore managers' voluntary disclosure decisions under this broader definition of uncertainty by looking at how ambiguity, alongside risk, is associated with management earnings and capital expenditure guidance and vice versa.

Recent theoretical models have shown that the inclusion of ambiguity-averse investors may result in different investor reactions to forecast news (e.g., Epstein and Schneider, 2008; Caskey, 2009; Illeditsch, 2011) than may be found in models that include only risk-averse investors (e.g., Diamond, 1985; Dye, 1985; Diamond & Verrecchia, 1991; Lewellen and Shanken, 2002; Pastor

and Veronesi, 2003). Theoretical models of the relationship between risk and voluntary disclosure have asserted that under a constant underlying distribution, by providing risk-averse investors with more information, managers increase the rate at which investors learn about their firms' economic fundamentals, causing a reduction in risk, which results in lower share price volatility (Brown, 1979; Dye, 1985; Lewellen and Shanken, 2002; Pastor and Veronesi, 2003). Recent studies have provided empirical support for the theoretical models' projections, showing that during an increase in volatility, managers issue more guidance and that this guidance reduces volatility (e.g., Rogers and Van Buskirk, 2013; Billing et al., 2015). However, models including both risk- and ambiguity-averse investors have suggested the possibility that more information might cause the opposite effect and increase stock price volatility (Epstein and Schneider, 2008; Caskey, 2009; Illeditsch, 2011). Therefore, considering only risk without ambiguity provides an incomplete or even misleading understanding of managers' voluntary disclosure decisions under uncertainty.

Ambiguity aversion reflects a high degree of caution. When faced with ambiguous information, ambiguity-averse investors maximize the expected utility under a worst-case belief about the quality of the ambiguous signal.[5] Thus, when faced with an ambiguous signal that conveys bad news, investors perceive that the news will last. On the other hand, when faced with a good signal, investors will believe that the good news is temporary and likely to reverse. Hence, ambiguity-averse investors pricing assets attach more weight to the worst-case scenario compared to investors who possess more exact information. Different investors' reaction to forecast news may thus lead to higher price volatility (Epstein and Schneider, 2008). Furthermore, small cash-flow news may cause a sudden change in ambiguity-averse investors' worst-case scenario beliefs,

[5] The term Ambiguous Signal originates from Epstein and Schneider (2008). They model a scenario where investors know that the true precision of an information signal is contained in a set of possible precisions, but cannot assess priors over this set (hence ambiguous information). In this scenario, the wider the range of possible signal precisions in the investor's set, the greater the ambiguity.

amplifying the effects of negative news shocks on stock prices, consequently leading to excess volatility again (Illeditsch, 2011).

Greater ambiguity exacerbates ambiguity-averse investors' reactions. This happens because higher ambiguity leads ambiguity-averse investors to assign more weight to the worst-case scenario (Izhakian and Yermack, 2017; Bailon et al., 2018; Augustin and Izhakian, 2020; Illeditsch et al., 2021). Sudden increases in ambiguity may cause shifts in perceptions to the worst-case scenario and tilts in probability distributions towards the worst-case scenarios, causing ambiguity-averse investors to overweight the perceived probabilities of future bad states, leading to higher price volatility when news is announced (Epstein and Schneider, 2008; Caskey, 2009; Illeditsch, 2011). Additionally, while risk aversion should induce the use of public information, ambiguity aversion may discourage the use of public information. Hard-to-interpret information can exacerbate ambiguity and would therefore likely be ignored by the ambiguity-averse investors with access to alternative sources of information (Caskey, 2009). Hence, in the presence of ambiguity-averse investors, the likelihood that new information may not be reflected in the prices increases with ambiguity (Illeditsch et al., 2021).

Recent empirical studies have corroborated these theoretical predictions. Williams (2015) shows that when macro ambiguity is amplified, investors place more weight on bad news earnings (i.e., shifting probabilities to the worst-case scenario). A working paper by Doan et al. (2018) provides evidence suggesting that ambiguity affects investors' participation in trading activity more than risk does.

Executives are also concerned about ambiguity. A recent survey showed that decision makers at firms think about the future in terms of probabilities when making sales forecasts, providing real-world evidence that managers' decisions are made in an ambiguous environment,

and that ambiguity plays a role in their forecasting of future outcomes (Bachmann et al., 2020). Similarly, a recent empirical study by Izhakian and Yermack (2017) suggested that managers are able to identify and differentiate between ambiguous and risky periods, explaining the early realization of employee stock options. Executives should be especially worried about ambiguity-averse investors, since high share price volatility may lead to terminal career repercussions (e.g., Engel et al., 2003; Bushman et al., 2010; Jenter and Lewellen, 2021), lawsuits (e.g., Kim and Skinner, 2012), and unfavorable capital market outcomes (e.g., Chordia et al., 2005).

While managers may not be able to control the underlying degree of ambiguity in their environment, they can control how they package and when they deliver information to investors (Epstein and Schneider, 2008; Caskey, 2009).[6] Hence, due to the pessimistic nature of ambiguity-averse investors, managers are encouraged to reduce voluntary disclosure during periods of heightened ambiguity, which leads to hypothesis one.[7]

H1 - An increase in firm-level ambiguity is associated with a reduction in the likelihood of management guidance.

Models of information processing by ambiguity-averse investors have suggested that new information may cause a sudden shift in the worst-case probability distribution, leading to an increase in ambiguity (Epstein and Schneider, 2008; Caskey, 2009; Illeditsch, 2011). Yet, if

[6] Furthermore, research has shown that managers use voluntary disclosure to help shape liquidity (Balakrishnan et al., 2014; Schoenfeld, 2017), deter and reduce the risk of the entrance of activist investors (Bourveau & Schoenfeld, 2017), receive feedback about desirable investment policy (Jayaraman & Wu, 2020), and associate disclosure with the threat of shareholder litigation (Bourveau et al., 2018; Houston et al., 2019).

[7] Managers may possess private information and/or may be ambiguity averse. In the former, while managers are motivated to engage in voluntary disclosure to reduce information asymmetry (e.g., Diamond, 1985; Diamond & Verrecchia, 1991) and stock price volatility (e.g., Dye, 1985), they understand that in the presence of ambiguity averse investors during high ambiguity periods, disclosing new information may result in amplified volatility (e.g., Epstein & Schneider, 2008), which reduces their willingness to provide voluntary disclosure. In the latter, managers overweight the perceived probability that the new information that they release may result in an amplified negative reaction by ambiguity averse investors (Epstein & Schneider, 2008; Caskey, 2009; Illeditsch, 2011), again lowering the managers' willingness to issue voluntary disclosure.

managers are ambiguity conscious, they are more likely to make disclosures in situations where the disclosure decreases, rather than increases, ambiguity. Theoretical and empirical evidence has indicated that managers are committed to disclosure to reduce investor uncertainty (e.g., Diamond, 1985; Dye, 1985; Diamond & Verrecchia, 1991; Lewellen and Shanken, 2002; Pastor and Veronesi, 2003, Billing et al., 2015), especially to avoid terminal implications for executives' careers (e.g., Engel et al., 2003; Bushman et al., 2010; Jenter and Lewellen, 2021). Furthermore, real-world, empirical, and theoretical evidence finds that managers are aware of ambiguity (Izhakian and Yermack, 2017; Bachmann et al., 2020) and may act to alleviate ambiguity-averse investors' concerns (Epstein and Schneider, 2008; Caskey, 2009). Specifically, managers may adjust their disclosure in highly ambiguous periods to cater to ambiguity-averse investors. In addition, H1 suggests that managers' decisions take ambiguity-averse investors' behavior in ambiguous periods into consideration. Therefore, if managers decide to provide voluntary disclosure, it is likely that they have incorporated ambiguity into their considerations. Hence, the disclosure provided will help investors to gather enough information to evaluate and resolve ambiguity, which leads to hypothesis two.

H2 - Ambiguity is reduced following guidance.

Chapter 3: Data and Sample Selection

3.1 Management Guidance Data

I begin my analysis by collecting data on management earnings and capital expenditure (CAPEX) guidance. I obtain earnings and CAPEX guidance data from the Institutional Brokers' Estimate System (IBES) Guidance database. I use data on both year and quarter guidance. I calculate variables *EarningsCount* and *CapexCount* as the count of earnings and CAPEX guidance in a fiscal quarter, respectively, based on the announcement date of the forecast. If, for the same

announcement date, there are both annual and quarterly forecasts for the same measure, I count them as one guidance. I use earnings guidance data on the full post-Reg-FD period of 2001 until the end of 2019.[8]

I then collect the report date of quarterly earnings announcements (rdq) for all firm-quarter observations in Compustat. Following Billings et al.'s (2015) framework and suggestions, I generate variables that provide information about the firm's guidance practices and history. I code variable *bundle* when a management forecast occurs during the five trading days centered around the earnings announcement (bundled forecasts). *Unbundle* indicates instances when the firm provides guidance in this quarter outside of the five-day window around rdq. *GuideCqtr* indicates whether the firm previously provided guidance for the current quarter's earnings. *BundlePrior* reflects whether the firm bundled earnings guidance with the prior quarter's earnings announcement. *RecentGuider* denotes firms with at least three instances of guidance in the prior 12 quarters. All bundle-related variables are related to the guidance type (e.g., when analyzing bundle in an earnings guidance framework, *bundle* refers to bundling earnings guidance; on the other hand, when analyzing bundle in a CAPEX guidance framework, *bundle* refers to bundling CAPEX guidance).

Following Rogers and Van Buskirk (2013), I create the following variables to control for the earnings announcement characteristics in my analysis. I collect analyst forecast data from IBES, using the unadjusted detail file three days prior to each earnings announcement. From this file, I collect the number of analyst forecasts (*numest*), conditional on the forecast being no more than 90 days old (i.e., non-stale), the median non-stale analyst forecast, and the standard deviation of non-stale analyst forecasts (*dispersion*). I measure each quarter's earnings surprise (*surprise*) as

[8] Following Jayaraman and Wu (2020), who showed that capital expenditure guidance had become prevalent after 2009, I use capital expenditure from the beginning of 2009 until the end of 2019.

the reported actual earnings (obtained from Compustat's quarterly files) minus the most recent median analyst estimates, deflated by the stock price at three trading days prior to the earnings release date. I code an indicator variable for positive earnings surprises (*PosSurprise* equals one if surprise > 0.0001) and negative earnings surprises (*NegSurprise* equals one if surprise < -0.0001). I code an indicator variable (*loss*) for firm-quarter observations where the firm reports negative earnings.

3.2 Firm-Related Data

I collect firm-related data from the Center for Research in Security Prices (CRSP) and Compustat. The following from CRSP are used to compute firm-level control variables: share price, return, number of shares, and volume data; the log market value of a firm's equity three days before an earnings announcement and at the end of a month (*mve*); the log volume of trading on *rdq* or the average in a month (*vol*); and the 90-day return ending three days prior to the earnings release date (*PriorRetRDQ*) and at the end of the quarter (*RetPre*). Compustat is used to derive the log book-to-market ratio (ceqq/(prccq*cshoq)) at the end of the fiscal quarter and the log firm value at the end of the fiscal quarter (prccq*cshoq)).

3.3 Risk Measure

I use option implied volatility (Ivol) derived from exchange-traded equity options prices to measure investor risk assessment. Ivol is an ex-ante, forward-looking measure of volatility that allows me to study how volatility changes around information events (Rogers et al., 2009). Billings et al. (2015) noted that since the volatility of future stock returns is positively correlated with the unknowns regarding the distribution of future earnings/cash flows (outcomes), a forward-looking measure of risk, such as Ivol, is a good proxy for investors' assessment of risk. In addition, Ivol has been extensively used in the past as a proxy of risk (e.g., Rogers et al., 2009; Billings et al.,

2015) and is considered to be reasonably available, market determined, and reflective of investors' beliefs about the uncertainty of future outcomes.

I gather close-of-day implied volatility data from the standardized option files of OptionMetrics. These are the implied volatilities on the 30-day, standardized, at-the-money options available for each day. This allows me to determine an average level of implied volatility in the days before a quarterly earnings release and at the end of the month or quarter (*IvolLevel*) and the changes in implied volatility over various time periods before (*ΔIvolPre*) and after (*ΔIvolPost*) quarterly earnings releases and at the end of months or quarters.

3.4 Ambiguity Measure

I follow the recent literature (Izhakian and Yermack, 2017; Brenner and Izhakian, 2018; Izhakian, 2020; Augustin and Izhakian, 2020) and employ a firm-level, monthly ambiguity measure, rooted in the decision theory framework of expect utility under uncertain probabilities (EUUP) (Izhakian 2017). In this framework, aversion to ambiguity takes the form of aversion to mean-preserving spreads in probabilities. Thus, the degree of ambiguity can be measured by the volatility of probabilities, just as the degree of risk can be measured by the volatility of outcomes. Another unique feature of the measure is that it is outcome independent. The measure of ambiguity considers the variation in the probabilities of events without incorporating the magnitudes of the outcomes associated with these events (outcome independence). By contrast, measures of risk consider the variation in the magnitudes of outcomes without incorporating the variation in the probabilities of associated events (outcome dependence) (Augustin and Izhakian, 2020). Because both risk and ambiguity might impact the disclosure decision, separating these different aspects of uncertainty is a critical prerequisite to assessing the impact of ambiguity on managers' disclosure decisions. Past studies have conducted extensive testing, showing that this measure of ambiguity

is unique in capturing a certain dimension of uncertainty that is not related to risk by controlling for alternative uncertainty factors, such as the volatility of return means, the volatility of return volatilities, disagreement among analysts, and VIX.[9] To alleviate any concern that my result might be influenced by other dimensions of uncertainty, my analysis also includes controls for risk and other factors that have been used in the past to capture uncertainty, such as VIX (Williams, 2015) collected from the CBOE Indexes database using Wharton Research Data Services (WRDS), EPU (Baker et al., 2016; Nagar et al.,2019) and disagreement among analysts (*dispersion*) (Anderson et al., 2009) collected from IBES.[10,11]

3.5 Estimating the Ambiguity Measure

I use a monthly, firm-level ambiguity measure described and calculated by Izhakian and Yermack (2017) and Brenner and Izhakian (2018). The measure's methodology and the data are publicly available, so that the measure can be used freely for replication.[12] These firm-level, monthly ambiguity observations are available for most traded firms beginning in 1993. This allows me to determine the level of ambiguity before an earnings announcement and at the end of the month or quarter (*Ambg*), as well as the changes in ambiguity over various time periods before (*ΔAmbPre*) and after (*ΔAmbPost*) quarterly earnings releases at the end of months or quarters.[13]

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[9] See Izhakian and Yermack (2017), Brenner and Izhakian (2018), and Augustin and Izhakian (2020) for a full set of robustness tests.

[10] The ambiguity measure that I employ is especially superior to disagreement among analysts (*dispersion*). First, the ambiguity measure is more generalized, since it only requires data on firm returns (Izhakian, 2020). Second, while the ambiguity measure that I use is outcome independent, dispersion is outcome dependent and highly correlated with volatility (Barinov, 2013; Palley, 2019; Izhakian, 2020). Third, dispersion is biased to analysts' incentives (Liu & Natarajan, 2012; Jurado, 2015) and attitudes toward ambiguity (Izhakian, 2020). Finally, disagreement among analysts might not even capture current uncertainty since analysts are slow in updating their forecasts (Liu & Natarajan, 2012; Jurado, 2015) and might reflect analysts' opinions rather than the economic environment (Jurado, 2015).

[11] The EPU index can be found on a website maintained by the authors of Baker et al., (2016): https://www.policyuncertainty.com/. Please see appendix A for information about the measure construction.

[12] The ambiguity measure can be found on Professor Yehuda (Yud) Izhakian's website: http://people.stern.nyu.edu/yizhakia/data.html.

[13] See Izhakian and Yermack (2017), Brenner and Izhakian (2018) and Izhakian (2020) for additional information about the methodology and theory of the ambiguity measure.

Chapter 4: Descriptive Statistics

Table 1 provides descriptive statistics for the two main management forecast samples. Panel A describes the earnings forecast sample. This sample consists of 85,917 firm-quarter earnings announcement observations from 2001 to 2019. More than half (44,324) are accompanied by earnings guidance (i.e., *bundle)*.[14] When I focus on quarters with a management forecast, I find that an overwhelming 93 percent of forecasts are bundled (*bundle*=1), while 33 percent of forecast quarters are also accompanied by an unbundled forecast (un*bundle*=1). The data show that the trend of increasing the issuance of bundled forecasts reported in the prior literature continues (Rogers and Van Buskirk, 2013; Billings et al., 2015). Focusing on bundled forecasts (*bundle*=1), I see that the majority of bundled firms have recently issued a forecast (*RecentGuider=1*). In addition, 26 percent of bundled quarters are accompanied by the issuance of additional unbundled forecasts. The inclusion of unbundled forecasts provides me with the variation needed to examine the trend of a manager's decision to issue a forecast on a quarterly basis.

Panel B describes the capital expenditure forecast sample. I use 46,399 firm-quarter earnings announcements from 2009 to 2019, approximately half of the earnings forecast sample that corresponds with the shorter sample period. Short of half of all quarters in the sample have a capital expenditure forecast bundled with an earnings announcement, showing how the prevalent CAPEX forecasts have become in the past decade, on par with recent capital expenditure forecast-focused research (Jayaraman and Wu, 2020). In terms of forecast quarters, an overwhelming 95.8 percent of capital expenditure forecasts are bundled with an earnings announcement. Bundled quarters are accompanied by 13.3 percent of unbundled forecasts, which again provides me with the variation required to examine the decision to issue a CAPEX forecast on a quarterly basis.

[14] The number of bundled forecasts in the time period is comparable to a recent study by Maslar et al., (2021).

[Table 1]

Table 2 presents summary statistics for the main uncertainty measures used in this paper. Panel A describes the distributions of these measures, while panel B shows the pairwise Pearson correlation coefficients between the uncertainty measures.

The change in ambiguity in the period preceding a management forecast (*ΔAmbPre*) captures any increases or decreases in firm-level ambiguity environment prior to management guidance. Panel B of Table 2 shows that the change in monthly ambiguity is weakly negatively correlated with the measures of risk commonly used in the voluntary disclosure literature, such as the change in firm-level implied volatility (*ΔIvolPre*; -0.028) and VIX (*Vix*; -0.054) (Rogers et al., 2009; Rogers and Van Buskirk, 2013; Billings et al., 2015). Furthermore, the degree of monthly ambiguity (*AmbgLevelPre*) has low negative correlation with the same measures of risk, which is consistent in magnitude and direction with the findings in recent literature (e.g., Brenner and Izhakian, 2018; Augustin and Izhakian, 2020). Analyst dispersion (*dispersion*), a measure previously used to proxy for ambiguity (Anderson et al., 2009), has an extremely low correlation with our measures of risk and ambiguity.

Finally, the change in monthly ambiguity is weakly positively correlated with monthly economic policy uncertainty (*EPU*; 0.079). The positive correlation is to be expected, since changes in the macro-economic and political environment, which are captured by EPU, influence and change firms' information environment (Baker et al., 2016; Nagar et al., 2019). For example, uncertainty about a new regulation increases ambiguity in related firms in an industry (Izhakian et al., 2021).

Overall, I show that the change in monthly ambiguity is weakly correlated with various measures of financial and economic uncertainty. This suggests that ambiguity captures a distinctly

unique aspect of firm-level financial and economic uncertainty, which coincides with the comprehensive tests in recent literature (e.g., Brenner & Izhakian, 2018; Augustin & Izhakian, 2020; Izhakian et al., 2021). More precisely, previous ambiguity literature has found that various firm-level characteristics (Izhakian et al., 2021) or events (Doan et al., 2018; Ben-Rephael and Izhakian, 2020) may be related to ambiguity (distinctly from risk). For example, companies with low growth opportunities or higher R&D intensity are likely to have higher ambiguity. Similarly, such events as M&A and debt increases may amplify ambiguity, while other events, such as analyst recommendations or credit rating changes, may decrease ambiguity.

[Table 2]

Chapter 5: Research Design and Results

5.1 The Decision to Issue Voluntary Disclosure

The tests in this section aim to capture whether firms provide less voluntary disclosure during periods of heightened ambiguity (H1). I do so by examining a set of prominent voluntary disclosure measures previously employed in the literature: earnings guidance (e.g., Rogers et al., 2009; Rogers and Van Buskirk, 2013; Billings et al., 2015; Bourveau and Schoenfeld, 2017; Bourveau et al., 2018; Maslar et al., 2021) and capital expenditure guidance (e.g., Jayaraman and Wu, 2020).

5.1.1 Guidance Behavior in A Quarter

To begin investigating whether increases in ambiguity are associated with changes in guidance behavior, I start my analysis by looking at earnings and capital expenditure guidance counts at the quarterly level. The quarterly guidance count has been used in the literature as a

general framework to study managers' voluntary disclosure decisions (e.g., Bourveau et al., 2018; Nagar et al., 2019). I estimate the following Poisson regression model (for count data), which builds upon the models of Rogers and Van Buskirk (2013) and Billings et al. (2015):[15]

$$\begin{aligned} Quarterly\ Forecast\ Count_{i,t} &= a_1(\Delta AmbPre_{i,t}) + a_2(Avg\Delta Amb4qPre_{i,t}) + a_3(AmbgLevelPre_{i,t}) \\ &+ a_4(\Delta IvolPre_{i,t}) + a_5(Avg\Delta Ivol4qPre_{i,t}) + a_6(IvolLevelPre_{i,t}) \\ &+ a_7(Vix_{i,t}) + a_8(\Delta Vix_{i,t}) + a_9(EPU_{i,t}) + a_{10}(\Delta EPU_{i,t}) + ErnAnncControl \\ &+ FirmControls + \varepsilon_{i,t} \end{aligned}$$

The quarterly earnings or capital expenditure guidance count in a fiscal quarter (*EarningsCount* or *CapexCount*) serves as the dependent variable. The main variable of interest is ambiguity change *(*Δ*AmbPre*), which captures the change in ambiguity in the preceding quarter. H1 predicts that ambiguity increases are negatively associated with the decision to issue a forecast (i.e., in this case, the number of total forecasts issued in a quarter). *Avg*Δ*Amb4qPre* is the average ambiguity change in the four preceding quarters, starting at the latest preceding quarter. *Avg*Δ*Amb4qPre* allows me to capture the regular information environment in a quarter and the regular market anticipation of ambiguity changes, which in turn permits the variable of interest, Δ*AmbPre*, to capture any abnormal changes in ambiguity.

In a broader attempt to determine the complete effect of uncertainty, which includes both risk and ambiguity, I also add a measure of changes in firm risk. Δ*IvolPre* captures the change in implied volatility in the preceding quarter, while *Avg*Δ*ivol4qPre* captures again the normal information environment in a quarter, allowing Δ*IvolPre* to capture any unanticipated or abnormal risk. As theory and previous evidence have suggested (Billings et al., 2015), changes in risk are expected to be positively related to the number of forecasts issued in a quarter.

[15] All results remain significant when the dependent variable used is the changes in guidance from quarter to quarter and when the previous quarter guidance is added as an independent variable.

In addition, *AmbgLevelPre* controls for the average *level* of firm ambiguity in the preceding quarter in the regression, while *IvolLevelPre* controls for the average level of firm risk in the preceding quarter.

Moreover, I control for market-wide volatility using VIX (*Vix* and ΔVix). ΔVix is especially important to control, as it has been used in the past to capture market-wide ambiguity (Williams, 2015). Although it has been used as a measure of macro ambiguity, ΔVix is outcome dependent and thus not separated from risk properly, while the measure of ambiguity that I employ is outcome independent (Brenner and Izhakian, 2018). In addition, Nagar et al. (2019) found that managers increase voluntary disclosure in response to increases in economic policy uncertainty. Hence, the results may be driven by changes in EPU rather than ambiguity, if the two are correlated. To account for EPU, I add both the change and the level of the previous period's EPU to the model.[16]

Furthermore, I control for various quarterly earnings announcement news characteristics, such as bundling, positive and negative earnings surprise in the quarter, *loss*, *dispersion*, and *numest*. I also control for various firm characteristics, such as size and book-to-market ratio. Finally, all regressions include robust standard errors and industry and year fixed effects.

Results for quarterly earnings and capital expenditure guidance counts are presented in Table 3. The left column reports results for the full sample of the quarterly count of earnings guidance (*EarningsCount*), while the right column reports results for the full sample of the quarterly count of capital guidance (*CapexCount*). I require that all firms have available ambiguity, OptionMetrics, CRSP, Compustat, and IBES data to be entered in my analysis.

I find that in all specifications in Table 3, the association between ambiguity changes and managers' willingness to issue a forecast is *negative*, providing support for H1. In terms of the

[16] I thank Professor Gilles Hilary for this helpful comment.

earnings guidance sample, this result is in opposition to the association between risk changes and guidance, which is positive confirming the findings of prior literature (e.g., Billings et al., 2015). This is a novel finding, corroborating theories that managers act differently under situations of risk and ambiguity. In terms of the capital expenditure guidance sample, changes in risk are not associated with guidance. Looking back at both samples, I find that uncertainty *levels* (risk and ambiguity) also play a distinct role in managers' choice to issue guidance.[17]

Overall, the results show that ambiguity has a distinct relation to managers' disclosure decisions and that, more importantly, this relation is in the opposite direction to that of risk, encouraging the notion that when evaluating uncertainty, both risk and ambiguity need to be considered together.

[Table 3]

5.1.2 The Decision to Bundle Guidance

I continue to explore managers' disclosure decisions under uncertainty using a more exact analysis. I focus on the periods of earnings announcements, studying the earnings and capital expenditure forecasts made at the same time as earnings news are released (i.e., bundled forecasts). Rogers and Van Buskirk (2013) and Billings et al. (2015) showed that over 90 percent of earnings guidance are bundled at times (I find that number to be closer to 93 percent), claiming that inferences on guidance policy should mainly take into account these majority forecasts. Jayaraman and Wu (2020) also showed how capital expenditure forecasts have become prominent in the

[17] Prior studies have supported the notion that managers will be less willing to supply information when uncertainty levels are high (e.g., Waymire, 1985; Bozanic et al., 2018). Bozanic et al. (2018) noted, "…managers, perhaps because they are also uncertain about future earnings, tend to remain silent even when investors would like more information" (p. 5). On the contrary, this study examines how changes in uncertainty are associated with guidance. This is an important distinction since prior studies (e.g., Billings et al., 2015; Balakrishnan et al., 2014) have found that short-term changes in uncertainty are positively associated with guidance, which is used as a means to curb investors' increased concerns.

recent decade, and I find that the vast majority, that is, 96 percent, of capital expenditure guidance forecasts are bundled.[18]

Next, I test if ambiguity changes are associated with the likelihood of bundling earnings or capital expenditure guidance with an earnings announcement. I estimate the following logit regression model:

$$\begin{aligned} bundle_{i,t} \; = a_0 + \; & a_1(\Delta AmbPre_{i,t}) + a_2(Avg\Delta Amb4qPre_{i,t}) + a_3(AmbgLevelPre_{i,t}) \\ & + a_4(\Delta IvolPre_{i,t}) + a_5(Avg\Delta Ivol4qPre_{i,t}) + a_6(IvolLevelpre_{i,t}) \\ & + a_7(dispersion_{i,t}) + a_8(GuideCqtr_{i,t}) + a_9(unbundle_{i,t}) \\ & + a_{10}(BundlePrior_{i,t}) + a_{11}(Vix_{i,t}) + a_{12}(\Delta Vix_{i,t}) + a_{13}(EPU_{i,t}) \\ & + a_{14}(\Delta EPU_{i,t}) + ErnAnncControl + FirmControls + \varepsilon_{i,t} \end{aligned}$$

The presence of a bundled earnings or capital expenditure forecast with the current quarter's earnings announcement (*bundle*) serves as the dependent variable. Δ*AmbPre* is calculated as the change in ambiguity in the month before the earnings announcement, while *Avg*Δ*ivol4qPre* is the average ambiguity change in the preceding four quarters. As previously discussed, the main variable of interest is ambiguity changes (Δ*AmbPre*), which captures any unanticipated increase in ambiguity above the normal information environment (*Avg*Δ*Ivol4qPre)*. H1 predicts that ambiguity increases are negatively associated with the decision to issue a forecast (i.e., in this case, the issuance of a bundled forecast).

I, again, include a measure of risk to study the complete effect of uncertainty. Δ*IvolPre* captures any unanticipated or abnormal risk. Δ*IvolPre* is the change in implied volatility in the 15 days preceding the earnings announcement. *Avg*Δ*Ivol4qPre* captures the normal information

[18] Focusing on bundled forecasts has many advantages. First, I am able to capture the effect of abnormal ambiguity on disclosure decisions more cleanly, since I use monthly ambiguity data rather than quarterly. Second, I am able to adopt the framework suggested by Billings at al. (2015), which aims to predict when a firm with a guiding history chooses to supply disclosure, rather than capture a firm's decision to initiate guidance. Third, my interpretation of the results is more valid since I am able to draw inferences based on the vast majority of forecasts. Fourth, focusing on earnings periods both with and without guidance provides me with a stable, defined period to run a regression analysis, especially when compared to unbundled guidance, which can be issued at any date, not just with earnings releases, and may include many uncontrollable confounding effects (Rogers & Van Buskirk, 2013).

environment before an announcement, calculated as the average Δ*IvolPre* in the preceding four quarters. The change in risk is expected to be positively related to bundled forecasts.

In addition, *AmbgLevelPre* controls for the average level of firm ambiguity in the month preceding the earnings announcement, while *IvolLevelPre* controls for the average level of firm risk in the five days before the earnings announcement.

Additionally, I control for the various quarterly earnings announcement news characteristics suggested by Rogers and Van Buskirk (2013). Controls include positive and negative surprise, loss, *dispersion*, *numest*, *GuideCqtr*, *BundlePrior*, *unbundle*, and *PriorReturnRDQ* (see the Data section for full variable descriptions). Capital expenditure samples also include an indicator for the presence of earnings guidance. Furthermore, I control for market-wide volatility using *Vix* and Δ*Vix,* and for economic policy uncertainty (*EPU* and Δ*EPU)*. I also control for various firm characteristics, such as size and book-to-market ratio. All regression models include robust standard errors and industry and year fixed effects.

Finally, I partition the sample based on guidance history (*RecentGuider = 1*). Prior work has suggested this method, claiming that benefits only come with a commitment to disclosure (Billings et al., 2015). This partition allows me to differentiate managers who are willing to guide from managers who initiate guidance. Thus, I am able to explain when guiding firms guide and when non-guiders initiate guidance.

Table 4 describes the results for bundled forecasts. I begin with columns [1] and [2], which present results for the full sample of earnings announcement quarters. For both samples, the relationship between ambiguity changes and managers' decision to bundle a forecast is *negative*, strengthening the results of the quarterly sample. Once again, in terms of the earnings guidance

sample, the measure of risk is positively related to the decision to bundle, emphasizing the differences between ambiguity and risk.

To assess managers' willingness to guide, columns [3] and [4] present results for those who commit to guidance. Results for both samples show that increases in ambiguity (*ΔAmbPre*) are associated with decreases in managers' willingness to provide guidance. In terms of earnings guidance, changes in risk (*ΔIvolPre*) and ambiguity have different associations with managers' willingness to guide.

Columns [5] and [6] can be seen as the managers' decision to begin or resume guidance. While the change in risk is not related to the decision to issue guidance, ambiguity changes are weakly and negatively related to the decision to bundle. All specifications show that firms are less likely to issue a forecast during higher uncertainty periods (*AmbgLevelPre* and *IvolLevelPre*).

Table 4 also reveals an interesting relation between changes in the economic-policy environment and the decision to bundle. More precisely, I find that guiding firms increase guidance in response to changes in EPU (*ΔEPU)*, while non-guiders are less likely to initiate disclosure. This suggests guiding firms use disclosure shape their information environment during periods of increased economic policy uncertainty (Nagar et al. 2019), while non-guiders are cautious about providing more information during turbulent times.

The main implication of the results is that when evaluating uncertainty effects on managers' guidance decisions, one must take both risk and ambiguity into account. I find that the relations of risk and ambiguity are opposite. More importantly, the results suggest that we might miss managers' behavior under uncertainty if we do not consider ambiguity. Not only does the capital expenditure guidance sample seem not to be associated with change in risk, but also the decision to *initiate* guidance does not seem to be associated with risk changes in the earnings

sample (column 5). Hence, analyzing guidance without including ambiguity shows only part of the effect of uncertainty. Even worse, one might think that guidance behavior is not associated with uncertainty in some cases. This only emphasizes the need to include ambiguity alongside risk when assessing uncertainty, as suggested by Knight (1921) and Keynes (1921).

[Table 4]

5.2 Ambiguity Following Voluntary Disclosure

In this section, I examine my second hypothesis, investigating whether managers' voluntary disclosure decisions are associated with a reduction of ambiguity. The previous section strongly supports the notion that managers are aware of ambiguity and react to the presence of ambiguity-averse investors. Considering this and prior theoretical and empirical evidence suggesting that managers are committed to disclosure to reduce investor uncertainty, I predict that managers' voluntary disclosure choices alleviate ambiguity-averse investors' concerns, which is related to a reduction in ambiguity. I examine this prediction by studying what happens to ambiguity following the issuance of voluntary disclosure. To do so, I examine whether bundled earnings releases are associated with declines in ambiguity by estimating the following regression model for all earnings announcements:

$$\begin{aligned}\Delta AmbPost_{i,t} \;=\; & a_0 + a_1(bundle_{i,t}) + a_2(\Delta AmbPre_{i,t}) + a_3(Avg\Delta Amb4qPost_{i,t}) \\ & + a_4(AmbgLevelPre_{i,t}) + a_5(\Delta IvolPost_{i,t}) + +a_6(\Delta IvolRdq_{i.t}) \\ & + a_7(Avg\Delta Ivol4qPost_{i,t}) + a_8(IvolLevelPre_{i,t}) + a_9(dispersion_{i,t}) \\ & + a_{10}(numest_{i.t}) + a_{11}(Vix_{i,t}) + a_{12}(\Delta Vix_{i,t}) + a_{13}(PosSurprise_{i,t}) \\ & + a_{14}(NegSurprise_{i,t}) + a_{15}(loss_{i,t}) + ErnAnncControl + FirmControls \\ & + \varepsilon_{i,t}\end{aligned}$$

The change in ambiguity following an earnings release ($\Delta AmbPost$) serves as the dependent variable in the regression. My second hypothesis predicts that the issuance of a bundled forecast is associated with abnormally large decreases in ambiguity (i.e., the coefficient on the bundle is negative).

The regression model is developed based on advice from Rogers et al. (2009) and Billings et al. (2015), with adjustments to the inclusion of ambiguity measures. I separate the change in ambiguity around a guidance into two distinct windows—pre-and post-guidance. This allows me to control for bias towards finding a positive relation between guidance and ambiguity, which might arise if a manager issues a bundled forecast in response to some ambiguity-provoking event.

Furthermore, the model allows me to control for pre-forecast movements in ambiguity when examining post-forecast ambiguity changes. In particular, if the change in pre-forecast ambiguity is greater, then I expect that the post-forecast reversion will likely be greater as well. The regression addresses this issue with the inclusion of the pre-forecast change in ambiguity ($\Delta AmbPre$) and the average change in post-forecast ambiguity from the prior four quarters ($Avg\Delta Amb4qPost$). Thus, my analysis captures the relationship between *bundle* and the abnormal change in ambiguity ($\Delta AmbPost$) after an earnings announcement. Hence, the test links abnormally large reversions in ambiguity to guidance after controlling for the change in ambiguity before a forecast ($\Delta AmbPre$) and after controlling for the typical ambiguity change ($Avg\Delta Amb4qpost$) that follows the firm's earnings announcement. Additionally, to make sure that results stem from ambiguity decline rather than risk decline, I add controls for pre- and post-earnings announcement volatility. I also add controls for the various quarterly earnings announcement news characteristics. Finally, I control for various firm characteristics, such as size and book-to-market ratio. All regressions include robust standard errors and industry and year fixed effects.

Table 5 reports the results for both earnings and capital expenditure guidance samples. The two samples are all firm-quarter observations with an earnings announcement.

The main findings in Table 5 are that when managers choose to include guidance with their earnings announcement, they are able to see consistently larger post-earnings announcement

decreases in ambiguity than the managers who choose not to include guidance, made evident by the significant negative coefficient on *bundle* and the consistency of this result across both earnings and capital expenditure samples. The result holds after controlling for the changes in ambiguity prior to the announcement, the typical changes in ambiguity following an announcement, and various other uncertainty measures, such as implied volatility, analyst forecast dispersion, and VIX. Furthermore, the results are robust after controlling for the earnings announcement news, showing that a loss announcement is associated with an increase in ambiguity, which is consistent with ambiguity-averse investors' belief that bad news will last and the continuing uncertainty that follows a loss (Williams, 2015). Capital expenditure sample results are also robust after controlling for the presence of earnings guidance at the same time, alleviating concerns that results might stem from bundling earnings guidance rather than from CAPEX guidance. In an additional untabulated analysis, I perform a falsification test, substituting the dependent variable with ambiguity change in the month after the earnings announcement. The falsification test shows that *Bundled* is insignificant, further strengthening the finding that the presence of a bundled forecast is associated with reduced ambiguity only following an earnings announcement.

The analysis shows strong empirical evidence that bundling guidance with an earnings announcement is associated with larger decreases in post-earnings announcement ambiguity than unbundled releases, providing support for my second hypothesis that managers use voluntary disclosure to aid in reducing ambiguity.

The overall results of this section are consistent with both hypotheses and theoretical predictions. The results strongly suggest that managers are aware of firm-level ambiguity and change their voluntary disclosure behavior in response and that their responses are associated with curbing firm-level ambiguity.

[Table 5]

5.3 The Cost of Guiding under Ambiguity

In this section, I empirically test whether providing guidance during high ambiguity periods has unfavorable capital market implications for firms. While theory has suggested that providing investors with new information during high ambiguity periods may lead to increases in stock price volatility and heightened negative stock price reactions (Epstein and Schneider, 2008; Caskey, 2009; Illeditsch, 2011), little-to-no direct empirical evidence exists on the matter (Illeditsch et al., 2021). In addition, the tests described in this section might provide additional insight into the results from previous sections that suggest that managers issue less guidance during abnormally high ambiguity periods.

5.3.1 Volatility Following a Bundled Forecast Conditioned on Forecast News and Ambiguity

I begin investigating the capital market reaction to guidance under ambiguity by estimating the following regression equation of the association between volatility subsequent to an earnings announcement and bundled earnings forecasts, conditioned on forecast news and ambiguity:

$$\begin{aligned} IvolPostAnnc_{i,t} &= a_0 + a_1(bundle_{i,t}) + a_2(Avg4qIvolPostAnnc_{i,t}) + a_3(\Delta IvolPostAnnc_{i,t}) \\ &+ a_4(\Delta IvolRdq_{i.t}) + a_5(\Delta IvolPre_{i,t}) + a_6(IvolLevelPre_{i,t}) \\ &+ a_7(dispersion_{i,t}) + a_8(numest_{i.t}) + a_9(Vix_{i,t}) + a_{10}(\Delta Vix_{i,t}) \\ &+ ErnAnncControl + FirmControls + \varepsilon_{i,t} \end{aligned}$$

The average implied volatility measured in the five days subsequent to an earnings announcement, *IvolPostAnnc*, serves as the dependent variable in the regression.

Theory has predicted that the coefficient on *bundle,* the association between bundled guidance and volatility following guidance, is dependent on forecast news and ambiguity. When ambiguity is low, both good (*BundleGoodForecast*) and bad (*BundleBadForecast*) news forecasts increase the rate at which investors learn about firms' economic fundamentals, causing a reduction in risk, which results in lower volatility (Dye, 1985; Lewellen and Shanken, 2002; Pastor and

Veronesi, 2003). However, when ambiguity is high, investors are pessimistic. When faced with bad news during high ambiguity periods, investors perceive that the news will last. Furthermore, higher levels of ambiguity may cause shifts in perceptions to the worst-case scenario and tilts in probability distributions towards the worst-case scenario, causing ambiguity-averse investors to overweight the perceived probabilities of future bad states, leading to higher price volatility when news is announced (Epstein and Schneider, 2008; Caskey, 2009; Illeditsch, 2011). Hence, a bad news forecast (*BundleBadForecast*) during high ambiguity periods is predicted to have a positive coefficient (i.e., a bad news forecast during high ambiguity is predicted to be associated with increased volatility). The direction of the coefficient on a good news forecast (*BundleGoodForecast*) is more complex. When faced with good news during high ambiguity periods, ambiguity-averse investors will believe that the good news is temporary and likely to reverse (Epstein and Schneider, 2008). On the other hand, good news forecasts may still resolve uncertainty. Hence, the association of good news forecasts with post-earnings volatility during high ambiguity periods remains an open empirical question.

The regression model that I employ separates pre-forecast movements in volatility from post-forecast volatility. The regression addresses this with the inclusion of the average and changes in pre-forecast volatility (*IvolLevelPre* and *ΔIvolPre*) and the average post-forecast volatility from the prior four quarters (*avg4qIvolPostAnnc*). Thus, my analysis captures the relationship between *Bundle* and the implied volatility (*IvolPostAnnc*) after an earnings announcement. Additionally, I add controls for changes in during- and post-earnings announcement volatility (*IvolRDQ* and *ΔIvolPostAnnc*). Finally, I control for various firm characteristics, such as size and book-to-market ratio, and the earnings surprise in the quarter. All regressions include robust standard errors and industry and year fixed effects.

Table 6 reports the results for all firm-quarter observations with an earnings announcement, conditioned on the firm-level ambiguity quartile.[19] Baseline results for the whole sample (column 1) show that *bundle* is associated with a reduction in average implied volatility following an earnings announcement, which is in accordance with prior studies (Billings et al., 2015).

I next focus on guidance under the lowest ambiguity quartile (columns 2–4). As predicted by theory, during low ambiguity periods, the association between bundling and implied volatility is negative, which remains consistent for good and bad news. When ambiguity is low, forecasts increase the rate at which investors learn about firms' economic fundamentals, causing a reduction in risk, which results in lower volatility.

I now turn to focus on guidance under the highest ambiguity quartile (columns 5–7). At first glance, I find that on average (column 5), bundling earnings forecast with an earnings announcement is not associated with volatility when ambiguity is high. Strikingly, disentangling the forecast news to good (column 6) and bad (column 7) reveals a pattern more consistent with theory. I find that a good news forecast is associated with lower volatility during high ambiguity periods. On the contrary, bad news forecasts are associated with increased volatility when ambiguity is high. The associated increase in volatility following a negative forecast under high ambiguity is consistent with theoretical predictions; it also provides insight into previous results suggesting that pre-earnings announcement ambiguity is negatively associated with guidance. The results suggest that managers avoid negative guidance under heightened ambiguity to avoid increases in volatility, which is consistent with the goal of reducing investor uncertainty (e.g., Diamond, 1985; Dye, 1985; Diamond & Verrecchia, 1991; Lewellen and Shanken, 2002; Pastor

[19] All results are robust to the alternative measure of dividing ambiguity according to quintiles (5-quantiles).

and Veronesi, 2003, Billing et al., 2015) and the adherence to career concerns (e.g., Engel et al., 2003; Bushman et al., 2010; Jenter and Lewellen, 2021).

[Table 6]

5.3.2 Abnormal Return Following a Bundled Forecast Conditioned on Forecast News and Ambiguity

Chart 1 describes the five-day cumulative abnormal return (CAR) around an earnings announcement conditioned on forecast news and ambiguity. Theory has predicted that during high ambiguity periods, forecast news may cause a sudden change in ambiguity-averse investors' worst-case scenario beliefs, amplifying the effects of negative news shocks on stock prices, consequently leading to heightened negative stock market reactions (Illeditsch, 2011). Accordingly, executives may be less incentivized to disclose bad news forecasts during high ambiguity periods since investors' reactions may be severe. Chart 1 supports this premise.[20] The negative reaction to bad news forecasts during high ambiguity periods (the highest firm ambiguity quartile) is thrice as bad as both the negative reaction to earnings announcements with no forecasts provided and the provision of bad news during low ambiguity periods (the lowest firm ambiguity quartile). On the other hand, bundling good news during high ambiguity periods shows insignificant positive abnormal return, which is better than not bundling. As expected, bundling during low ambiguity periods has a positive significant abnormal return.

Finally, Kothari et al. (2009) found that investors react more strongly to bad news forecasts, concluding that managers withhold and delay bad news. While the evidence in this paper is consistent with their results, Chart 1 provides a novel incentive for such behavior. By delaying the release of bad forecasts during high ambiguity periods, managers may be able to curb the

[20] Estimation window used is [-110, -11] trading days before an earnings announcement. I employ the market-adjusted model abnormal returns defined in excess of CRSP Value-weighted market return.

heightened negative stock market reactions of ambiguity-averse investors. Such behavior by executives assists in curbing both risk and ambiguity, which is associated with reduced uncertainty.

[Chart 1 here]

Chapter 6: Conclusion

Ambiguity, the uncertainty about the probabilities of events, is similar to risk, the uncertainty about outcomes; both come into consideration in the countless real-life choices that we make. In this paper, I investigate whether the voluntary disclosure decisions that executives make are associated with firm-level ambiguity. This allows me to examine how managers' voluntary disclosures are related to a broader construct of uncertainty that involves both risk and ambiguity.

My research is motivated by theory, empirical and survey work. Theoretical models have suggested that managers should consider the presence of ambiguity-averse investors when providing investors with information (e.g., Epstein and Schneider, 2008; Caskey, 2009). Support for this theory can be found in recent survey work showing that managers take probability intervals into account when forecasting (Bachmann et al., 2020) and empirical research showing that managers' decisions are ambiguity dependent (Izhakian and Yermack, 2017).

Using a novel monthly, firm-level ambiguity measure (Izhakian and Yermack, 2017; Izhakian, 2020), I find strong evidence that firms' voluntary disclosure decisions are associated with both risk and ambiguity. I find that managers issue less earnings and capital expenditure guidance during periods of heightened ambiguity, which is in opposition to their behavior during periods of heightened risk (Billings et al., 2015). This finding alone stresses the importance of including both ambiguity and risk when analyzing uncertainty and voluntary disclosure decisions.

At the second stage, I test whether managers' choices are beneficial by investigating whether their disclosure decisions are associated with a reduction of ambiguity. Controlling for pre-forecast ambiguity and typical ambiguity after an announcement, I find that issuing guidance along with an earnings release is related to a reduction in ambiguity. This finding, along with the finding that managers disclose less during periods of heightened ambiguity, suggests that managers identify occasions when disclosure is beneficial for reducing investor uncertainty.

Finally, I provide novel empirical evidence showing the adverse capital market consequences that guiding under ambiguity might have. When ambiguity is high, bad news forecasts are associated with increased share price volatility and significant negative abnormal return. I do not observe the same reaction when ambiguity is low.

This paper contributes to the literature by studying broad voluntary disclosure practices, including earnings and capital expenditure guidance, under a larger construct of uncertainty that includes both risk and ambiguity. In addition, I confirm theoretical predictions regarding managers' choices in the presence of ambiguity-averse investors (e.g., Epstein and Schneider, 2008; Caskey, 2009). Most importantly, I provide novel empirical evidence suggesting that by adjusting their voluntary disclosure, executives are able to alleviate ambiguity-averse investors' concerns. Finally, the evidence that I provide lends support for the recent interest in ambiguity (Cascaldi-Garcia et al., 2020), showing that when assessing uncertainty, one must consider not only risk, but ambiguity as well.

Appendix A – Variable Definitions

All samples described in the paper are subject to available Compustat, CRSP, I/B/E/S, OptionMetrics, and ambiguity data. I winsorize all continuous firm-quarter or firm-month observations at the 1% and 99% levels.

EarningsCount	The of earnings and CAPEX guidance in a fiscal quarter
CapexCount	The of capital expenditure guidance in a fiscal quarter
bundle	An indicator variable set to 1 if the firm provides an earnings forecast during the five-day window surrounding the report date of quarterly earnings.
BundleGoodForecast	An indicator variable set to 1 if bundle =1 and the forecast estimate is higher than the pre-forecast prevailing median analyst estimate.
BundleBadForecast	An indicator variable set to 1 if bundle =1 and the forecast estimate is less than the pre-forecast prevailing median analyst estimate.
GuideCqtr	An indicator variable set to 1 if the firm previously provided earnings guidance for the current quarter's earnings.
BundlePrior	An indicator variable set to 1 if the firm issued an earnings forecast during the five-day window surrounding the report date of quarterly earnings in the last quarter.
unbundle	An indicator set to 1 if the firm provides any unbundled guidance during the current quarter.
RecentGuider	An indicator set to 1 if the firm is a guiding firm, as measured by the presence of at least three pieces of guidance in the prior 12 quarters.
surprise	Actual earnings minus the prevailing median analyst estimate, deflated by the stock price at three trading days prior to the report date of quarterly earnings.
PosSurprise	An indicator variable set to 1 if this quarter's earnings surprise exceeds +0.0001.
NegSurprise	An indicator variable set to 1 if this quarter's earnings surprise falls below -0.0001.
loss	An indicator variable set to 1 if actual earnings are less than 0.
dispersion	The standard deviation of prevailing analyst estimates for the current period's earnings.
numest	The number of analysts with outstanding estimates three trading days prior to the report date of quarterly earnings.
PriorRetRDQ	The 90-day return ending three days prior to the earnings release date.
RetPre	The 90-day return ending at the end of the quarter.
mve	The log of the market value of a firm's equity three days before an earnings announcement (CRSP number-of-shares-outstanding*price) or at the end of a quarter (Compustat prccq*cshoq).
vol	The log volume of trading on rdq or the average in a month.
book-to-market ratio	Log of Compustat items (ceqq/(prccq*cshoq)) at the end of the fiscal quarter.

IvolLevelPre	Earnings announcement sample - the average level of implied volatility (ivol) for a 30-day duration, at-the-money option in the five trading days prior to the report date of quarterly earnings.
	Quarterly count sample - the average level of ivol for a 30-day duration, at-the-money option in the previous quarter.
ΔIvolPre	Earnings announcement sample - the natural logarithm of the ratio of the ivol (for a 30-day duration standardized option) measured at the close of the day prior to the report date of quarterly earnings to the ivol measured 15 days prior to the report date of quarterly earnings (i.e., the change in ivol in the 15 days prior to the earnings release).
	Quarterly count sample - the natural logarithm of the ratio of the ivol (for a 30-day duration standardized option) measured at the close of the day prior to the beginning of the quarter to the ivol measured 90 days prior to the beginning of the quarter (i.e., the change in ivol in the previous quarter).
ΔIvolRdq	The natural logarithm of the ratio of the ivol (for a 30-day duration standardized option) measured at the close of the report date of quarterly earnings to the ivol measured at the close of the day prior to the report date of quarterly earnings (i.e., the change in ivol on the day of the earnings release).
ΔIvolPost	Earnings announcement sample - the natural logarithm of the ratio of the ivol (for a 30-day duration standardized option) measured 15 days after the report date of quarterly earnings to the ivol measured at the close of the report date of quarterly earnings (i.e., the change in ivol in the 15 days following the earnings release).
	Quarterly count sample - the natural logarithm of the ratio of the ivol (for a 30-day duration standardized option) measured at the end of the quarter to the ivol measured at the beginning of the quarter (i.e., the change in ivol in the quarter).
IvolPostAnnc	The average level of ivol for a 30-day duration, at-the-money option in the five trading days following the report date of quarterly earnings.
ΔIvolPostAnnc	The natural logarithm of the ratio of the ivol (for a 30-day duration standardized option) measured five days after the report date of quarterly earnings to the ivol measured at the close of the report date of quarterly earnings (i.e., the change in ivol in the five days following the earnings release).
avgΔIvol4qPre	The average of ΔIvolPre for the prior four quarters (i.e., 12 months).
avgΔIvol4qPost	The average of ΔIvolPost for the prior four quarters (i.e., 12 months).
avg4qIvolPostAnnc	The average of IvolPostAnnc for the prior four quarters (i.e., 12 months).
AmbgLevelPre	The monthly, firm-level ambiguity. The measure can be found on Professor Yehuda (Yud) Izhakian's site: http://people.stern.nyu.edu/yizhakia/data.html.
	AmbgLevelPre is the prior end-of-the-month, firm-level ambiguity.
	For the quarterly count sample only, AmbgLevelPre is the average monthly ambiguity level in the previous quarter.

ΔAmbPre	Earnings announcement sample - the ratio of the ambiguity at the end of the month prior to the month of earnings announcement to the ambiguity at the end of two months prior to the month of earnings announcement, minus one (i.e., the change in ambiguity in the month prior to the month of earnings release).
	Quarterly count sample - the ratio of the three-month average end-of-the-month ambiguity in the prior quarter to the three-month average end-of-the-month ambiguity in the two quarters prior, minus one (i.e., the change in the three-month average ambiguity in the prior quarter).
ΔAmbPost	Earnings announcement sample - the ratio of the ambiguity at the end of the month of the earnings announcement to the ambiguity at the end of the month prior to the month of the earnings announcement, minus one (i.e., the change in ambiguity in the month of the earnings release).
avgΔAmb4qPre	The average of avgΔAmb4qPre for the prior four quarters (i.e., 12 months).
avgΔ4Amb4qPost	The average of avgΔ4Amb4qPost for the prior four quarters (i.e., 12 months).
Vix	The level of the Chicago Board Options Exchange's Volatility Index (VIX) on the report date of quarterly earnings or at the end of the month or quarter.
ΔVix	Earnings announcement sample - the natural logarithm of the ratio of the *Vix* measured one day after the earnings announcement to the *Vix* measured one day prior to the earnings announcement.
	Quarterly count sample – the natural logarithm of the ratio of the *Vix* measured at the end of the quarter to the *Vix* measured at the beginning of the quarter.
EPU	Earnings announcement sample - prior end-of-the-month, US economic political uncertainty level. Maintained and updated by the authors of Baker et al. 2016: https://www.policyuncertainty.com/us_monthly.html
	Quarterly count sample – prior end-of-the-quarter, US economic political uncertainty level.
ΔEPU	Earnings announcement sample - the ratio of EPU at the end of the month prior to the month of earnings announcement to EPU at the end of two months prior to the month of earnings announcement, minus one (i.e., the change in EPU in the month prior to the month of earnings release).
	Quarterly count sample - the ratio of EPU at the end-of-the-month in the prior quarter to the EPU at the end-of-the-month in the two quarters prior, minus one (i.e., the change in the EPU in the prior quarter).

Table 1. Descriptive Statistics for Management Forecast Sample

Panel A

	Forecast Quarters (n = 47,597)			All Quarters (n = 85,917)			Bundle = 1 (n = 44,324)			Bundle = 0 (n = 41,593)		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
bundle	0.931	1.000	0.253	0.516	1.000	0.500						
unbundle	0.313	0.000	0.464	0.174	0.000	0.379	0.263	0.000	0.440	0.079	0.000	0.269
RecentGuider	0.822	1.000	0.383	0.550	1.000	0.497	0.848	1.000	0.359	0.233	0.000	0.423
BundlePrior	0.868	1.000	0.338	0.481	0.000	0.500	0.906	1.000	0.291	0.027	0.000	0.163
PosSurprise	0.679	1.000	0.467	0.640	1.000	0.480	0.688	1.000	0.463	0.588	1.000	0.492
NegSurprise	0.193	0.000	0.395	0.248	0.000	0.432	0.192	0.000	0.394	0.307	0.000	0.461
loss	0.072	0.000	0.259	0.117	0.000	0.322	0.063	0.000	0.244	0.175	0.000	0.380
PriorRetRDQ	0.036	0.035	0.225	0.037	0.033	0.240	0.041	0.039	0.218	0.033	0.026	0.262
mve	14.943	14.853	1.513	14.787	14.674	1.547	14.975	14.884	1.505	14.588	14.448	1.566
numest	8.340	7.000	5.480	8.332	7.000	5.738	8.261	7.000	5.456	8.407	7.000	6.023

Note. The panel provides summary of the earnings forecast sample. The sample consists of 85,917 firm-quarter observations from 2001 to 2019. All Quarters provide descriptive statistics regarding all firm earnings announcement quarters, while Forecast Quarters provide descriptive statistics only for the quarters with earnings management forecasts. Two final sub-tables show the full sample partitioned based on the presence of a bundled forecast. All variables are defined in the Data section. All variable definitions can be found in Appendix A.

Panel B

	Forecast Quarters (n = 22,882)			All Quarters (n = 46,399)			Bundle = 1 (n = 21,922)			Bundle = 0 (n = 24,477)		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
bundle	0.958	1.000	0.200	0.472	0.000	0.499						
unbundle	0.169	0.000	0.375	0.084	0.000	0.277	0.133	0.000	0.340	0.039	0.000	0.194
RecentGuider	0.875	1.000	0.331	0.625	1.000	0.484	0.880	1.000	0.325	0.396	0.000	0.489
BundlePrior	0.797	1.000	0.402	0.393	0.000	0.488	0.812	1.000	0.390	0.018	0.000	0.131
PosSurprise	0.646	1.000	0.478	0.648	1.000	0.477	0.646	1.000	0.478	0.651	1.000	0.477
NegSurprise	0.271	0.000	0.445	0.268	0.000	0.443	0.272	0.000	0.445	0.264	0.000	0.441
loss	0.107	0.000	0.310	0.117	0.000	0.322	0.108	0.000	0.311	0.125	0.000	0.331
PriorRetRDQ	0.063	0.051	0.231	0.063	0.051	0.226	0.063	0.051	0.231	0.064	0.052	0.222
mve	14.903	14.819	1.473	14.884	14.785	1.568	14.872	14.793	1.460	14.895	14.773	1.659
numest	9.212	7.000	6.513	8.728	7.000	6.202	9.101	7.000	6.460	8.394	7.000	5.942

Note. The panel provides a summary of the capital expenditure forecast sample. The sample consists of 46,399 firm-quarter observations from 2009 to 2019. All Quarters provide descriptive statistics regarding all firm earnings announcement quarters, while Forecast Quarters provide descriptive statistics only for the quarters with capital expenditure management forecasts. Two final sub-tables show the full sample partitioned based on the presence of a bundled forecast. All variables are defined in the Data section. All variable definitions can be found in Appendix A.

Table 2. Descriptive Statistics for Uncertainty Measures

Panel A

	N	Mean	p25	Median	p75	Std. Dev.
ΔAmbPre	85,917	0.112	-0.204	0.030	0.322	0.806
AmbgLevelPre	85,917	0.007	0.002	0.005	0.009	0.010
ΔIvolPre	85,917	0.042	-0.054	0.031	0.129	0.182
IvolLevelPre	85,917	0.438	0.295	0.396	0.530	0.205
Vix	85,917	19.180	13.400	16.600	21.840	8.919
ΔVix	85,917	-0.002	-0.058	-0.010	0.045	0.096
EPU	85,917	112.538	88.985	102.771	132.799	35.266
ΔEPU	85,917	-0.027	-0.144	-0.052	0.069	0.200
dispersion	85,917	0.043	0.011	0.021	0.043	0.133

Note. The panel provides a summary of the main uncertainty measures used throughout this paper. The sample consists of 85,917 firm-quarter observations from 2001 to 2019. *ΔAmbPre* is the change in ambiguity in the month prior to the month of earnings announcement. *ΔIvolPre* is the change in 30-day duration, at-the-money option implied volatility in the 15 days prior to the earnings announcement. *AmbgLevelPre* is the firm-level ambiguity in the month prior to the month of earnings announcement. *IvolLevelPre* is the average level of implied volatility for a 30-day duration, at-the-money option in the five trading days prior to the earnings announcement. The descriptive statistics provide summary regarding all firm earnings announcement quarters in the time period. All variable definitions can be found in Appendix A.

Panel B

	ΔambPre	AmbgLevelPre	ΔIvolPre	IvolLevelPre	Vix	ΔVix	EPU	ΔEPU	Dispersion
ΔAmbPre	1								
AmbgLevelPre	0.317	1							
ΔIvolPre	-0.028	0.044	1						
IvolLevelPre	-0.062	-0.447	0.099	1					
Vix	-0.054	-0.203	0.054	0.467	1				
ΔVix	0.011	0.018	-0.004	-0.038	0.020	1			
EPU	0.079	-0.058	-0.121	0.118	0.265	-0.040	1		
ΔEPU	0.044	-0.021	-0.037	0.024	0.037	-0.014	0.370	1	
dispersion	0.000	-0.018	-0.014	0.061	0.019	0.003	0.025	-0.003	1

Note. The panel presents pairwise Pearson correlation coefficients between the main uncertainty measures used throughout this paper. The sample consists of 85,917 firm-quarter observations from 2001 to 2019. *ΔAmbPre* is the change in ambiguity in the month prior to the month of earnings announcement. *ΔIvolPre* is the change in 30-day duration, at-the-money option implied volatility in the 15 days prior to the earnings announcement. *AmbgLevelPre* is the firm-level ambiguity in the month prior to the month of earnings announcement. *IvolLevelPre* is the average level of implied volatility for a 30-day duration, at-the-money option in the five trading days prior to the earnings announcement. The descriptive pairwise correlation regards all firm earnings announcement quarters in the time period. All variable definitions can be found in Appendix A.

Table 3. Uncertainty and Quarterly Forecasts

Dependent Variable	**EarningsCount**	**CapexCount**
ΔAmbPre	**-0.105*** **	**-0.051***
	(0.000)	**(0.079)**
avgΔAmb4qPre	-0.006	0.066***
	(0.659)	(0.009)
AmbgLevelPre	1.290***	-9.766***
	(0.009)	(0.000)
ΔIvolPre	**0.110*** **	**0.000**
	(0.000)	**(0.994)**
avgΔIvol4qPre	0.501***	0.033
	(0.000)	(0.639)
IvolLevelPre	-1.082***	-0.466***
	(0.000)	(0.000)
Vix	0.011***	0.005***
	(0.000)	(0.007)
ΔVix	-0.147***	-0.093***
	(0.000)	(0.007)
EPU	-0.000	0.000
	(0.535)	(0.638)
ΔEPU	0.009	0.011
	(0.658)	(0.714)
Controls	Yes	Yes
Observations (firm-quarter)	85,917	46,399
Fixed Effects	Year & Industry	Year & Industry
Regression Model	Poisson	Poisson

Note. The analysis tests the Poisson regression of the quarterly count of earnings (*EarningsCount*) and capital expenditure (*CapexCount*) forecasts on various uncertainty measures. *ΔAmbPre* is the change in the three-month average ambiguity in the previous quarter. *ΔIvolPre* is the change in 30-day duration, at-the-money option implied volatility in the previous quarter. The sample for the earnings guidance consists of 85,917 firm-quarter observations from 2001 to 2019; the sample for the capital expenditure guidance consists of 46,399 firm-quarter observations from 2009 to 2019. I require that all firms have available ambiguity, OptionMetrics, CRSP, Compustat, and IBES data. All regressions include industry and year fixed effects. Additional controls included in the regression: an indicator for a *bundle* quarter, earnings news in quarter (*surprise, PosSurprise, NegSurprise, loss*), *mve, book-to-market ratio, and dispersion*. Robust p-values are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All variable definitions can be found in Appendix A.

Table 4. Uncertainty and Bundled Forecasts

Dependent Variable	bundle					
	All Firms		RecentGuider = 1		RecentGuider = 0	
	Earnings	Capex	Earnings	Capex	Earnings	Capex
	[1]	[2]	[3]	[4]	[5]	[6]
ΔAmbPre	**-0.082*** **	**-0.108** **	**-0.053** **	**-0.097** **	**-0.082** **	**-0.342*** **
	(0.000)	**(0.011)**	**(0.048)**	**(0.023)**	**(0.036)**	**(0.002)**
avgΔAmb4qPre	-0.055	0.007	-0.057	0.084	-0.037	-0.349*
	(0.339)	(0.946)	(0.505)	(0.356)	(0.674)	(0.084)
AmbgLevelPre	-2.294	-11.923***	-11.721***	-11.192***	-1.642	-14.110***
	(0.148)	(0.000)	(0.000)	(0.000)	(0.704)	(0.006)
ΔIvolPre	**0.178** **	**0.019**	**0.282** **	**0.180**	**0.055**	**-0.051**
	(0.042)	**(0.878)**	**(0.024)**	**(0.164)**	**(0.697)**	**(0.823)**
avgΔIvol4qPre	0.334**	0.105	0.251	0.104	0.317	-0.115
	(0.027)	(0.667)	(0.242)	(0.684)	(0.218)	(0.792)
IvolLevelPre	-0.864***	0.122	-1.417***	-0.180	-0.322*	0.325
	(0.000)	(0.529)	(0.000)	(0.391)	(0.093)	(0.322)
dispersion	-0.425	0.200	-0.289**	0.229	-1.300	0.073
	(0.145)	(0.158)	(0.015)	(0.440)	(0.197)	(0.758)
GuideCqtr	1.829***	3.967***	1.605***	3.646***	1.645***	6.360***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
unbundle	-0.836***	-4.028***	-1.144***	-2.925***	-0.511***	-5.839***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
BundlePrior	5.182***	4.582***	4.883***	4.305***	4.259***	5.063***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Vix	-0.003	-0.004	-0.006	-0.014**	0.003	0.004
	(0.257)	(0.435)	(0.110)	(0.015)	(0.545)	(0.705)
ΔVix	0.239	0.208	0.328	-0.078	0.098	0.242
	(0.102)	(0.320)	(0.121)	(0.723)	(0.693)	(0.541)
EPU	0.000	0.002	-0.001	0.004***	0.003*	-0.001
	(0.689)	(0.176)	(0.329)	(0.004)	(0.075)	(0.578)
ΔEPU	0.132	0.001	0.520***	0.034	-0.312*	-0.001
	(0.191)	(0.994)	(0.000)	(0.825)	(0.054)	(0.997)
Constant	0.179	-2.541***	1.073***	-2.352***	-1.119**	-1.264*
	(0.605)	(0.000)	(0.006)	(0.000)	(0.019)	(0.096)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations (firm-quarter)	85,917	46,399	44,324	21,922	41,593	24,477
Fixed Effects	Year & Industry	Year & Industry	Year & Industry	Year & Industry	Year & Industry	Year & Industry
Regression Model	Logit	Logit	Logit	Logit	Logit	Logit

Note. The analysis tests the logit regression of the decision to issue voluntary management earnings or capital expenditure guidance with an earnings announcement (*bundle)* on various uncertainty measures. *ΔAmbPre* is the change in ambiguity in the month prior to the month of earnings announcement. *ΔIvolPre* is the change in 30-day duration, at-the-money option implied volatility in the 15 days prior to the earnings announcement. I further partition the sample based on *RecentGuider* to capture both managers' willingness to guide and managers' decision to initiate guidance. The sample for the earnings guidance consists of 85,917 firm-quarter observations from 2001 to 2019; the sample for the capital expenditure guidance consists of 46,399 firm-quarter observations from 2009 to 2019. I require that all firms have available ambiguity, OptionMetrics, CRSP, Compustat, and IBES data. Additional controls included in the regression: earnings news in quarter (*surprise, PosSurprise, NegSurprise, loss*), *mve, book-to-market ratio, PriorRetRDQ, and vol*. For the capex sample, I include controls for the presence of earnings guidance at the same time. All regressions include industry and year fixed effects. Robust p-values are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All variable definitions can be found in Appendix A.

Table 5. Ambiguity Following a Forecast

Dependent Variable	**ΔAmbPost**	
	Earnings Forecast	CAPEX Forecast
bundle	**-0.044*** **	**-0.062*** **
	(0.000)	**(0.001)**
ΔambPre	-0.050***	-0.014**
	(0.000)	(0.017)
avgΔ4Amb4qPost	-0.040***	-0.025
	(0.000)	(0.308)
AmbgLevelPre	-5.831***	-2.989***
	(0.000)	(0.000)
ΔIvolPost	-0.218***	-0.518***
	(0.000)	(0.000)
ΔIvolRDQ	-0.167***	-0.959***
	(0.000)	(0.000)
avgΔIvol4qPost	0.095***	-0.015
	(0.000)	(0.772)
IvolLevelPre	-0.218***	-0.692***
	(0.000)	(0.000)
dispersion	0.006	0.038
	(0.774)	(0.471)
numest	0.001	-0.004**
	(0.362)	(0.010)
Vix	-0.009***	-0.007***
	(0.000)	(0.000)
ΔVix	-0.301***	-0.175***
	(0.000)	(0.006)
PosSurprise	-0.016*	0.002
	(0.051)	(0.927)
NegSurprise	-0.026***	0.006
	(0.005)	(0.831)
loss	0.022**	0.008
	(0.016)	(0.750)
Constant	0.546***	1.066***
	(0.000)	(0.000)
Controls	Yes	Yes
Observations (firm-quarter)	85,818	46,349
Fixed Effects	Year & Industry	Year & Industry
Regression Model	Linear	Linear
Adjusted R-squared	0.0342	0.0165

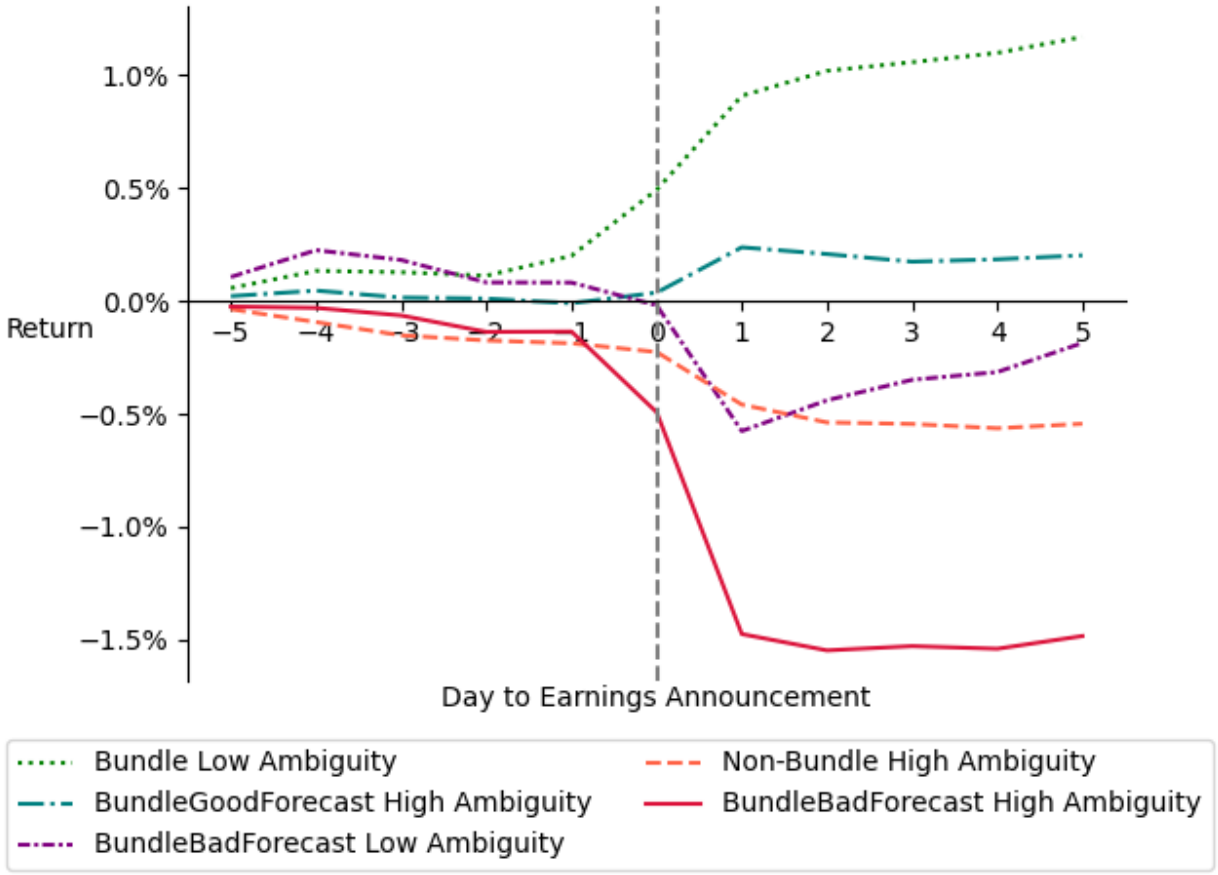
Note. The analysis tests the relation between changes in ambiguity following an earnings announcement (*ΔAmbPos*t) and the decision to issue voluntary management guidance with an earnings announcement (*bundle)*. *Bundle* is an indicator variable if the firm provides voluntary management earnings or capital expenditure guidance during the period of an earnings announcement. The sample for the earnings guidance consists of 85,818 firm-quarter observations from 2001 to 2019; the sample for the capital expenditure guidance consists of 46,349 firm-quarter observations from 2009 to 2019. I require that all firms have available ambiguity, OptionMetrics, CRSP, Compustat, and IBES data. All regressions include industry and year fixed effects. Additional controls included in the regression: *mve, book-to-market ratio, vol, PriorRetRDQ*. For the capex sample, I include controls for the presence of earnings guidance at the same time. Robust p-values are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All variable definitions can be found in Appendix A.

Table 6. Implied Volatility Following a Bundled Forecast Conditioned on Forecast News and Ambiguity

Dependent Variable	IvolPostAnnc						
		Ambiguity					
	All	Low	Low	Low	High	High	High
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
bundle	**-0.002*** **	**-0.004*** **			**-0.001**		
	(0.000)	**(0.000)**			**(0.381)**		
BundleGoodForecast			**-0.002** **			**-0.002** **	
			(0.036)			**(0.017)**	
BundleBadForecast				**-0.003** **			**0.002** **
				(0.047)			**(0.048)**
avg4qIvolPostAnnc	0.121***	0.088***	0.089***	0.089***	0.168***	0.167***	0.169***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ΔIvolPostAnnc	0.277***	0.396***	0.396***	0.396***	0.218***	0.218***	0.218***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
IvolLevelPre	0.780***	0.822***	0.822***	0.822***	0.703***	0.703***	0.703***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ΔIvolRDQ	0.276***	0.383***	0.383***	0.383***	0.219***	0.219***	0.219***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ΔIvolPre	0.078***	0.097***	0.096***	0.096***	0.074***	0.074***	0.074***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
dispersion	0.004***	0.007**	0.007***	0.008***	-0.002	-0.002	-0.002
	(0.005)	(0.010)	(0.009)	(0.008)	(0.323)	(0.295)	(0.319)
numest	0.000**	0.000	0.000	0.000	-0.000	-0.000	-0.000
	(0.017)	(0.146)	(0.139)	(0.127)	(0.423)	(0.433)	(0.487)
Vix	0.001***	0.001***	0.001***	0.001***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ΔVix	0.018***	0.023***	0.023***	0.023***	0.015***	0.015***	0.015***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.036***	0.060***	0.059***	0.060***	0.017**	0.017***	0.016**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.013)	(0.009)	(0.016)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	`
Observations (firm-quarter)	87,430	18,640	18,640	18,640	16,280	16,280	16,280
Fixed Effects	Year & Industry	Year & Industry	Year & Industry	Year & Industry	Year & Industry	Year & Industry	Year & Industry
Regression Model	Linear	Linear	Linear	Linear	Linear	Linear	Linear
Adjusted R-squared	0.944	0.948	0.948	0.948	0.912	0.912	0.912

Note. The analysis tests the relation between implied volatility following an earnings announcement (*IvolPostAnnc***)** and the presence of voluntary management guidance with an earnings announcement (*bundle*), conditioned on the ambiguity quartile prior to the earnings announcement. *Bundle* is an indicator variable if the firm provides a voluntary management earnings forecast, *BundleGoodForecast* is an indicator variable if the forecast is above the median analyst forecast, and *BundleBadForecast* is an indicator variable if the forecast is below the median analyst forecast. All ambiguity includes all firm-quarter observations. Low ambiguity refers to firms-quarter in the lowest ambiguity quartile, while high ambiguity refers to firms-quarter in the highest ambiguity quartile prior to the earnings announcement. All results are robust to the alternative measure of dividing ambiguity according to quintiles (5-quantiles). The sample for the earnings guidance consists of 87,430 firm-quarter observations from 2001 to 2019. I require that all firms have available OptionMetrics, CRSP, Compustat, and IBES data. Additional controls included in the regression: *mve, book-to-market ratio, vol*, *unbundle*, *surprise, PosSurprise and NegSurprise*. All regressions include industry and year fixed effects. Robust p-values are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All variable definitions can be found in Appendix A.

Chart 1. Cumulative Abnormal Return Around Earnings Announcement Based on Bundling and Ambiguity



Note. The chart presents the mean cumulative abnormal return (CAR) around the five-day window of a quarterly earnings announcement based on whether firms issue earnings forecast with the quarterly earnings announcement (*bundle*), the news of the forecast, and the ambiguity quartile prior to the earnings announcement.
Bundle is an indicator variable if the firm provides a voluntary management earnings forecast, *BundleGoodForecast* is an indicator variable if the forecast is above the median analyst forecast, and *BundleBadForecast* is an indicator variable if the forecast is below the median analyst forecast. Low ambiguity refers to firms in the lowest ambiguity quartile, while high ambiguity refers to firms in the highest ambiguity quartile prior to the earnings announcement. Estimation window is [-110, -11] trading days before an earnings announcement. I employ the market-adjusted model abnormal returns defined in excess of CRSP Value-weighted market return. All variable definitions can be found in Appendix A.

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