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Disclosure strategies for management earnings forecasts: The role of managerial compensation structures, overoptimism, and effort

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ABSTRACT

Management earnings forecasts have received significant attention as an important source for setting firm expectations. Our paper argues that how these forecasts are presented to the public is important for managing these expectations. We present both analytical and empirical analyses demonstrating that managers' disclosure framing choices will depend on the information type, managerial overoptimism, and managerial compensation structures. We also provide evidence showing that disclosure framing choices can dampen stock return volatility. Finally, we indicate that disclosure strategies alter the misreporting results found in Guttman et al. (2006).

1. Introduction

Expectations regarding earnings are essential not only because they indicate what financial experts think might happen next for a company, but because they set the tone for security trading during the short term. A stock price often goes down if the company misses, and typically goes up if the company exceeds expectations. For examplet:

Wall Street analysts were disappointed in Tesla's first-quarter delivery and production figures. Shares of the company plunged 9 percent late Wednesday after Tesla said it delivered 50,900 Model 3 cars in the first quarter, below the 52,450 analysts expected in a consensus estimate from FactSet. Overall deliveries also fell short of consensus estimates (CNBC News, April 4, 2019).[1]

Management earnings forecasts have received significant attention as an important source for setting firm expectations[2]; most of the literature [3] focuses on the *informativeness* and *price reactions* of these voluntary disclosures. Yet another key aspect of communication concerning how messages are framed and presented is also important for managing expectations (Block and Keller, 1995; Kirchler et al., 2005; Maynard, 2017). For example, Levin et al. (1998) describe how two differently phrased but logically equivalent messages could have different effects on people's opinions, judgments, and attitudes toward a given object, event, or outcome. How will managers deliver the bad news if they know that there will be an earnings crash? Will they hide the bad news by confusing investors with a higher earnings forecast? This can prevent a sudden depreciation in the current stock

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[1] https://www.cnbc.com/2019/04/04/tesla-plunges-nearly-8percent-after-analysts-say-deliveries-were-substantially-worse-than-expected.html

[2] The literature suggests that there is significant demand from capital market participants for the disclosure of earnings forecasts by managers (see Healy and Palepu, 2001; Core, 2001 for reviews).

[3] Beyer et al. (2010) provide a thorough survey of recent works on management earnings forecasts.

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price, but the stock price will eventually drop when the final low earnings are realized. Will managers instead try to reveal this bad news by confusing investors with a lower earnings forecast? This will create a sudden depreciation in the current stock price, but the stock price will eventually rise when the final earnings are revealed to be higher.

Tversky and Kahneman (1981) demonstrate reversed preferences between two options presented in positive versus negative framing. Positive framing emphasizes benefits, while negative framing emphasizes losses; decision-makers tend to minimize risks when contemplating benefits, and to overlook losses when contemplating failures (Kahneman, 1979; Tversky and Kahneman, 1981).

We employ the framing concepts from Kahneman (1979) and Tversky and Kahneman (1981) into managing earnings forecasts by supposing that managers are privately informed of a firm's earnings level. For positive framing managers will manage the perception of firm performance and risk by framing earnings disclosures with increasing levels. That is, managers may make an earnings forecast that shows the current stock price as less than an unbiased report (an actual earnings report) would. Managers will accordingly frame the forecast in such a way that when the actual earnings are released the stock price increases. Conversely, for negative framing managers will manage the perception of losses by framing earnings disclosures that show decreasing levels. That is, managers may make an earnings forecast suggesting that the current stock price will be higher than an unbiased report would. Managers will accordingly frame the forecast in such a way that when the actual earnings are released the stock price decreases.

Our research question is: will managers also strategically manipulate disclosure frames in order to take advantage of investors' cognition biases? We have seen evidence showing that managers are more likely to preempt the release of bad versus good news (Skinner, 1994; Kasznik and Lev, 1995; Bies, 2013), delay the release of bad news (Dye and Sridhar, 1995; Acharya et al., 2011; Clark and LaBeff, 1982; Gallo, 2015[4]), or simultaneously delay the disclosure of good news and accelerate the release of bad news prior to options award periods (Aboody and Kasznik, 2000). However, little research has yet addressed how managers choose their disclosure strategies, or how these decisions are related to either managers' personal traits or companies' governance structures.[5]

Our paper provides the first attempt to demonstrate how managers' disclosure framing depends on the type of information (either good or bad news), managerial overoptimism, and compensation structures. We first use a simple model where managers consider the trade-off between various incentives when determining disclosure framing. Intuitively, manipulating disclosure frames has three possible impacts on executive compensation: equity-based awards benefits, implicit loss in performance bonuses, and explicit manipulation costs. The incentives to choose either positive or negative disclosure framing are affected by executives' compensation structures that combine all of these terms, information type, managerial overoptimism, and managers' effort decisions. This simple model helps clarify these interacting factors and develop predictions regarding how executive compensation structures affect managers' disclosure framing, how these disclosure choices vary with managerial overoptimism, and how disclosure choices affect managerial effort. We then test these predictions by examining a sample of company-issued guidance data from Thomson Reuters' Institutional Brokers' Estimate System (I/B/E/S) for the period from 2009 to 2017.

The model is an adaptation of Guttman et al. (2006) which addresses how managers issue forecasts in order to maximize stock prices. Guttman et al. (2006) show the existence of partial pooling equilibria where for either very low or high levels of earnings the manager's reports reveal the true earnings, while for intermediate earnings levels there is some noise in the report. Guttman et al. (2006) model provides a nice linkage between earnings reports and stock prices, but there is no discussion concerning the agency problem where managers' effort decisions can also affect the actual earnings levels, in turn influencing managers' disclosure choices. Our paper complements this study considering the interactions among forecasts, effort and actual earnings. Specifically, we first consider a compensation scheme with equity-based awards and performance bonuses Ellig (2001), then calculate the optimal difference between the stock price following the earnings forecast announcement versus the stock price when the actual earnings are released. This sign of this price difference indicates managers' two disclosure choices: positive or negative framing. If the optimal choice for the price difference is "zero" then it suggests a separating equilibrium similar to Guttman et al. (2006). However, if the optimal choice for the price difference is "non-zero" then this suggests a partial pooling equilibrium similar to Guttman et al. (2006). We further distinguish these cases with positive versus negative price differences by showing the linkage between manager disclosure choices with information types, overoptimism, and compensation structures. Moreover, we derive the manager's optimal effort decisions and show how disclosure choices and effort decisions change with the information type, manager overoptimism, and compensation structures. Beyer et al. (2010) note that, "models that further explore optimal compensation structures and consider their effect on management's disclosure decisions have the potential to provide new insights into both firms' disclosure behavior and optimal incentive structures.".

Throughout this paper good or bad news are defined in terms of earnings changes, while positive or negative framing is defined in terms of price changes (i.e., the difference between the current price when the news is released and the price when the actual earnings are released). "Good news" accordingly refers to cases with earnings increases and "bad news"

[4] https://hbr.org/2015/03/how-to-deliver-bad-news-to-your-employee. How to deliver bad news to your employees, Harvard Business Review, March 30, 2015.

[5] Soffer et al. (2000) find that managers with bad news release essentially all of their news on the preannouncement date, while managers with good news only release about half of their news. Libby and Tan (1999) also show that analysts' forecasts of future earnings are lower when bad news is released in two parts versus all at once. These two studies above do not examine the role of equity incentives and managerial traits in determining firms' disclosure decisions.

to those with earnings decreases. "Positive framing" means choosing a negative price difference (an upward price pattern), while "negative framing" means choosing a positive price difference (a downward price pattern). These interpretations are: for good news positive framing means that the manager chooses a negative price difference where the good news is released bit by bit until the actual earnings are realized to be an increase in earnings. On the other hand, negative framing means that the manager chooses a positive price difference where good news is released upfront in order to push up the stock price first and later bring the price down. For bad news positive framing means the manager chooses a negative price difference where the bad news is released immediately in order to push down the stock price first and later bring it up. On the other hand, negative framing means that the manager chooses a positive price difference where the bad news is released bit by bit until the actual earnings are realized to be a decrease in earnings.

We accordingly investigate how disclosure choices are affected by managers' compensation structures, information types, and managerial overoptimism. Moreover, we want to know how managers' effort decisions are affected by these disclosure choices, information types, and managerial overoptimism. The extant literature has provided evidence that management earnings forecasts are a channel for communicating with investors and increasing firm visibility while reducing share price volatility. We further want to examine whether disclosure choice framing will also dampen stock price volatility. Guttman et al. (2006) provide a prediction that misreporting level (i.e., the difference between earnings forecasts and actual earnings) is associated with equity-related compensations as well as manipulation costs. Finally, our examination of this prediction lets us know whether or not disclosure framing alters the misreporting results of Guttman et al. (2006).

In Appendix A we present an analytical model characterizing various strategic concerns behind disclosure framing choices. We then investigate a sample of company-issued guidance data from Thomson Reuters I/B/E/S for the period from 2009 to 2017 where we consider the aggregate measures of compensation structures consisting of equity-based compensation and non-equity-based compensation. Equity-based compensation is based on stock price performance that includes both stock awards and options awards, while non-equity-based compensation is based on realized earnings that includes both salaries and bonuses (Bernardo et al., 2016). Our regression results support most of these model predictions, which are summarized as follows.

First, we provide evidence of preponderance for positive disclosure framing for good news (i.e., delaying the release of good news) as well as marginally more positive disclosure framing for bad news (i.e., accelerating the release of bad news). This means that delaying the release of good news and accelerating the release of bad news is possible.

Second, regarding the choice of disclosure framing our results indicate that both compensation structures and overoptimism are associated with managers' disclosure framing choices. Specifically, our results show that when the proportion of non-equity-based awards increases then managers are more likely to use negative disclosure framing, but we fail to find a relationship between equity-based awards and disclosure framing. Moreover, our results show that optimistic managers are more likely to use positive disclosure framing for good news, but this relation is no longer apparent for bad news. These results are robust after including investor sentiments known to be related to voluntary disclosure policies. The takeaway points from these results are the following. Managerial overoptimism enhances the incentive for delaying the release of good news, while for bad news the effect of managerial overoptimism on disclosure framing choices is ambiguous. Additionally, performance bonuses incentivize negative disclosure framing for either good or bad news (i.e., accelerating the release of good news or delaying the release of bad news).

Third, our results show that for good news managers' effort levels are positively associated with the possibility of using positive disclosure framing and managerial overoptimism, while for bad news managers' effort levels are negatively associated with the possibility of using positive disclosure framing and managerial overoptimism. These results are robust after considering a two-stage least squares (2*SLS*) regression when conducting the potential endogeneity problem between framing and managerial effort.

Fourth, we further examine the relationship between positive disclosure framing and stock return volatility. Consulting company McKinsey (Hsieh et al., 2006) argues that providing earnings guidance helps executives maintain an open channel of communication with investors, increasing the visibility of those companies while reducing the volatility of share prices and improving share valuations. We show that disclosure framing is an alternative channel for both communicating with firm investors and increasing visibility while reducing share price volatility. Specifically, our results indicate that positive disclosure framing is negatively associated with stock return volatility for either good or bad news, while this is more strengthened for good news. These results are in line with the viewpoint of the consulting company McKinsey (Hsieh et al., 2006) suggesting that investors have greater confidence in positive disclosure framing for good versus bad news.

Fifth, we examine the relation among misreporting, equity-based compensation, and internal control. The separating equilibrium of Guttman et al. (2006) suggests that the misreporting level is related to equity-based compensations as well as manipulation costs. In final testing, we examine this relationship and check whether disclosure framing and effort allocation alters the results of misreporting in Guttman et al. (2006)[6]. Our empirical results indicate that the misreporting level is unrelated to either equity-based awards or internal control quality. However, the misreporting level is positively related to capital intensity. These results indicate that equity-based compensation does not motivate misreporting, implying that managerial compensation is not frequently related to earnings via stock prices. Managers therefore have fewer incentives to manipulate earnings. These are similar to the empirical results finding that disclosure framing is unrelated to equity-based compensation.

[6] We are thankful for the anonymous reviewer's suggestion for this.

Our model concludes that both disclosure framing and managerial effort levels are related to managerial optimism, the type of news (good or bad), and non-equity-related compensation. Our empirical results also confirm the significance of these relations. These pieces of evidence suggest that disclosure framing and effort decisions alter the misreporting results in found in Guttman et al. (2006) such that managers are motivated by either behavioral concerns (managerial optimism) or corporate governance structures (non-equity-related compensation) in conveying information via disclosure framing.

Our empirical results and practical implications are threefold. First, our results show that managers' disclosure framing choices are affected by both compensation structures and their anticipation of firm prospects. In particular, non-equity-based awards will motivate managers to adopt negative framing, while optimism concerning firm prospects may lead these managers to adopt positive framing for good news (i.e., delaying the release of good news). Second, the choice of disclosure framing may tie into managerial effort decisions. Our results show that managers tend to adopt positive framing for good news in order to commit themselves with a high effort level. We further show that managerial over-optimism will lead to high effort levels. Third, our results provide several implications for managers, shareholders, corporate boards, investors, and analysts. (1) Our analyses are helpful for managers to evaluate their disclosure strategies, which we show will affect their effort decisions in coordination with their framing decisions. (2) For shareholders and board members our results suggest that the design of managerial incentive structures should consider the presence of managerial over-optimism since both factors will affect managers' disclosure decisions and effort allocation. (3) For investors and analysts our analyses provide a framework for evaluating the quantity and quality of the information contained in management earnings forecast disclosures.

This paper aims at contributing to existing studies from four aspects. First, the prior literature on voluntary disclosures has primarily focused on whetherto disclose[7]. Our paper focuses on how to disclose or communicate. This focus on how (rather than whether) to disclose leads us to distinguish between which news to deliver and when to respectively delay or accelerate its delivery. Our paper both provides evidence on this distinction and documents that either good or bad news may be delayed and accelerated. Our paper further suggests that if "not revealing" can significantly impact investors' perspectives, then "the methods to reveal the news" should also influence how investors form their expectations. More importantly, we document that such managerial choices of which news to announce and when to respectively delay or accelerate are related to managerial rewards (nonequity-based compensation, such as salary), rather than simply presenting the relevance.[8]Our study explores optimal compensation structures and considers their effects on management forecast decisions, providing new insights into firm forecast behaviors and optimal incentive structures. Second, our model incorporates disclosure decisions alongside effort allocation, extending the extant research Guttman et al. (2006) by furthering our understanding of how (framing in) managerial forecasts affect not only stock price changes by influencing investors' pricing and but also a firm's real decisions. This suggests that (framing in) management forecasts is value-relevant. To our knowledge no empirical or theoretical work has yet addressed how managers' disclosure choices can also signal pre-commitment to certain effort levels, which directly impacts firm value. Third, our study also suggests that CEO characteristics such as managerial overoptimism impact management disclosure behaviors and effort allocation. Although previous empirical work has documented the relation between management forecasts and overoptimism Hribar and Yang (2016), our analytical model further demonstrates that both managers' effort decisions and disclosure choices are affected by managerial overoptimism and underlying compensation structures due to agency problems. Fourth, previous experimental studies have investigated how either penalty or bonus framing can change effort decisions, finding that penalty framing induces a greater level of effort than bonus framing (Luft, 1994; Hannan et al., 2005; Hossain and List, 2012; Hong et al., 2015; Levitt et al., 2016). Additionally, the literature addresses the impacts of bonus versus penalty framing on risky behavior (Chowdhury et al., 2018; Morgan and Sisak, 2016; Oblak et al., 2018). To our knowledge our study is the first addressing framing effects in management forecasts both empirically and theoretically.

The remainder of the paper is organized as follows. Section 2 briefly describes the data sources and variables used in our empirical testing. Section 3 presents the empirical models and main results using a sample of company-issued guidance data from Thomson Reuters I/B/E/S for the period from 2009 to 2017. Section 4 contains several robustness checks for these results. Section 5 provides further analyses. Section 6 concludes the paper. In order to retain a smooth flow of the manuscript, Appendix A contains our analytical model in which a privately-informed manager issues an earnings forecast signaling his or her information concerning both a firm's prospects and his or her effort decision. Public investors will subsequently determine the stock price based on this forecast. All our empirical predictions are derived from this analytical model. Appendix B describes the detailed measurement for variables used in our regressions. Finally, Appendix C presents the descriptive statistics and correlation matrix for these variables.

[7] The prior literature on voluntary disclosures for either good or bad news focuses on the disclosure timing. Prior literature asks whether and why managers withhold bad news (Dye, 1986; Verrecchia, 1983), as well as why managers disclose good news earlier than bad news (Skinner, 1994; Kasznik and Lev, 1995; Kothari et al., 2009; Dye and Sridhar, 1995; Acharya et al., 2011; Pinello, 2008).

[8] Yermack (1997) and Aboody and Kasznik (2000) show that managers either accelerate bad news and/or withhold good news during the period immediately preceding options grant dates in order to lower the exercise price of options.

2. Data Sources and Variables

We investigate a sample of 40,404 company-issued guidance data from Thomson Reuters I/B/E/S for the period from 2009 to 2017. We have deleted observations whose forecasts are not earnings per share (EPS), whose company types are not COM, whose forecasts are not yearly, and whose stock market details are not in the CUSIP dataset.

Next we download SIC codes from the COLEV file in the Execucomp dataset and combine the SIC codes with our sample data. We delete observations with no SIC codes and observations from financial firms and public utilities whose SIC codes are 4900–4999 and 6000–6999. We measure CEO overoptimism by deleting observations with no EXECID data (Unique Executive ID Number). For the remaining 8,936 observation, we further delete observations with forecasts announcing dates later than fiscal period end (FPE) or observations that contain no stock price data on the forecast announcing date (PRCCF) in the CRSP dataset. Next, since we are interested in managers' yearly performance we only keep the first forecast of the year and delete subsequent revisions. Finally, for the remaining observations we combine the (reported) actual EPS from the Thomson Reuters I/B/E/S database and delete observations where we cannot find the actual EPS from I/B/E/S.

Throughout the paper "good news" refers to cases with earnings increases, and "bad news" to those with earnings decreases. *Positive framing* means to deliberately release news such that the difference between the current price and the price when actual earnings are released is *negative*; *negative framing* means to deliberately release news such that the difference between the current price and the price when actual earnings are released is *positive*. We accordingly define the type of news using the earnings difference and disclosure framing choices using the price difference.

2.1. Measurement of Variables of Interest

Here, we provide the notion of constructs for variables of interest, such as disclosure framing, managerial effort, managerial overoptimism, and managerial compensation (equity-based and non-equity-based). We additionally provide the notion of controlled variable measurements for our empirical specification and testing. Specifically, we illustrate that these variables of interest are constructed based on either related parameter definitions in the analytical model or well-known definitions in the accounting literature.

(A) Information Type

In the analytical model, the information type is defined as the difference between a firm's prospects (u) and its mean (m). For good news $u - m > 0$, and for bad news $u - m < 0$. In addition investors may use the actual earnings from the previous period in order to form their prior beliefs concerning the firm's actual earnings during the current period.

Based on this we use the difference between the (reported) actual EPS for the current year and the actual EPS from the previous year as a proxy for either good or bad news in our empirical specification. If the difference is positive, it is good news; if the difference is negative, it is bad news.

(B) Disclosure Framing

According to our analytical model, either positive or negative disclosure framing is a sign of the price difference between the stock price following the earnings forecast announcement and the stock price when the actual earnings are released. Let Φ denote the price difference. For good news positive framing (i.e., $\Phi < 0$) means a negative price difference where managers release the good news bit by bit until the actual earnings are realized as an increase; negative framing (i.e., $\Phi > 0$) means a positive price difference, where managers release good news in order to push up the stock price up front until the actual earnings are realized as a decrease. In contrast, for bad news positive framing (i.e., $\Phi < 0$) means a negative price difference where managers release bad news in order to push down the stock price up front and expect it to increase later; negative framing (i.e., $\Phi > 0$) means a positive price difference where managers release the bad news bit by bit until the actual earnings are realized as a decrease.

Based on the partial pooling equilibrium, we measure disclosure framing by the price difference between the three-day average stock price following the announcement of management forecasts and the three-day average stock price after reporting the actual EPS in our empirical specification. For good or bad news, *positive framing* refers to the case where the price difference is negative, while *negative framing* refers to the case where the price difference is positive. We indicate the choice of disclosure framing by defining a dummy variable. *Positive Framing* indicating whether the manager's disclosure framing is for good or bad news. That is:

$$\begin{aligned} Positive\_Framing &= 1, \text{ if } \Phi < 0, \\ Negative\_Framing &= 0, \text{ if } \Phi > 0. \end{aligned}$$

(C) Managerial Effort

In the analytical model there is a one-on-one relationship between the manager's effort levels (e) and the firm's output levels (x) (i.e., $x(e,u) = \lambda e^{\theta} u^{1-\theta}$) in which the manager's effort is the crucial determinant for sales growth, while the firm's future perspective (u) is the manager's private information and is treated as exogenously given. However, to our knowledge there exists no appropriate measurement for managerial effort levels within the accounting literature. We accordingly use sales growth as a proxy for a manager's effort levels.

(D) Managerial Overoptimism

An agent is considered optimistic if he or she believes that good outcomes are more likely than they are (i.e., in an asymmetric sense). An agent is considered overconfident if he or she believes that the information he or she possesses is more precise than it is (i.e., in the sense of an underestimation of variance).

The literature has proposed three measurements for overoptimism or overconfidence, such as Malmendier and Tate (2005); Jin and Kothari (2008); and Ben-David et al. (2013). First, Malmendier and Tate (2005) classify managers as overoptimistic if they overexpose themselves to their firms' idiosyncratic risk. They further designate managers as overoptimistic if they exercise options later than the optimal date, hold their options until expiration, or increase their company stock holdings. Second, Malmendier and Tate (2005) and Jin and Kothari (2008) propose a press-based measure since it does not suffer from the same endogeneity and omitted variable explanations as the equity-based measure of overoptimism. Third, Ben-David et al. (2013) measure executives' confidence bounds when asked to estimate a stock index's future performance. Overconfidence can then be defined as having too-narrow confidence intervals relative to the stock index's historical distribution (i.e., variance).

Notice that there is a difference between the notion of managerial overoptimism or overconfidence as examined in Malmendier and Tate (2005); Jin and Kothari (2008); and Ben-David et al. (2013). Malmendier and Tate (2005), Malmendier and Tate (2008) are motivated by the "better than average" effect, where individuals overestimate their acumen relative to others. This upward bias in the assessment of future events is referred to as overoptimism. In contrast, Ben-David et al. (2013) define overconfidence as too-narrow confidence intervals when predicting probabilistic events, regardless of whether the expectation is biased or not.

In our paper the measure of managerial overoptimism is based on the manager's options exercise decisions and follows the rationale proposed by Malmendier and Tate (2005); Malmendier and Tate (2008). The measure identifies a manager as optimistic if he or she holds on to stock options longer than is expected from a manager with unbiased beliefs. The intuition behind this approach is that a risk-averse manager is expected to reduce his or her exposure to company-specific risk by exercising his stock options early if they are sufficiently deep in the money (see, e.g., Hall and Murphy, 2002; Huddart Lang, 1996). Holding on to an option until late in the option's life, even though the option is already deep in the money, is therefore considered evidence for optimistic beliefs regarding the firm's prospects. Moreover, this rationale is also consistent with our analytical model in which an exogenous parameter ($\lambda > 1$) is used to capture a manager's excessive belief that future earnings will be higher. For our purpose we will use the options-based overoptimism measure.

We delete 1,204 more observations due to missing data, where managerial overoptimism cannot be defined, or where either positive or negative framing in disclosures for good and bad news cannot be defined. The total number of overoptimistic and non-overoptimistic CEOs for the good and bad news accordingly includes 1,068 effective firm-year observations.

Following Malmendier and Tate (2005) and Hirshleifer et al. (2012) we calculate the manager's options portfolio's average moneyness for each year. First, for each CEO year we calculate the average realizable value per option by dividing the total realizable value of the options by the number of options held by the CEO. Next, the strike price is calculated as the fiscal year-end stock price minus the options' average realizable value. The options' average moneyness is then calculated as the stock price divided by the estimated strike price minus one. We are only interested in options that the CEO can exercise, so we include only the CEO's vested options. Finally, following Malmendier and Tate (2005), Malmendier and Tate (2008) we define a dummy variable (*Overoptimism*) which takes a value of 1 if a CEO postpones the exercise of vested options that are at least 67% in the money at least twice during the sample period, and 0 otherwise. If a CEO is identified as overoptimistic by this measure then he or she remains the same for the rest of the sample period. This treatment is consistent with the notion that overoptimism is a persistent trait (Hirshleifer et al., 2012). As mentioned by Malmendier and Tate (2005) in p.2675:

> *Of particular interest is the relations among stock ownership, vested options, and our overconfidence measures. Mechanistically, an overconfident CEO who delays option exercise or purchases additional company stock will increase his holdings. However, other factors such as firm size, firm age, corporate governance, and tenure are substantially more important in determining the level of ownership. Overall, it is not surprising that there is no consistent correlation between stock or options ownership and overconfidence measures. Further, the board typically grants stock and options to confer incentives on the CEO.*

Based on our 1,068 effective firm-year observations the correlations between managerial overoptimism and equity-based compensation is -0.14, while that between managerial overoptimism and options award is 0.10[9]; all of these are acceptable when it comes to avoiding either the multicollinearity or high correlation problem between these measurements. This result is also consistent with the argument from Malmendier and Tate (2005). It is therefore feasible to use the options-based measure of managerial overoptimism as the explanatory variable and the equity-based compensation as the controlled variable in our empirical specification.

Based on our 1,068 effective firm-year observations 61.4% of our observations managers are classified as overoptimistic, and 38.6% are classified as non-overoptimistic. This result is consistent with the average percentage for the period from 1993 to 2003 (61.08%, according to Hirshleifer, Low, and Teoh, 2012).

(E) Managerial Compensation

In this paper managerial compensation structures primarily consist of equity-based compensation and non-equity-based compensation, where equity-based compensation including stock awards and options awards is based on stock price perfor-

[9] See Appendix C for the correlation between variables of interest.

mance, while non-equity-based compensation including salaries and bonuses, is based on realized earnings. This setting is also consistent with the concept from Bernardo et al. (2016).

In our empirical specification we consider the following two aggregate measures of compensation, i.e.:

$$Equity\text{-}Based\_Comp = Stock\_Awards + Option\_Awards$$
$$Non\_Equity\text{-}Based\_Comp = Salary + Bonus,$$

where is *Stock_Awards* is defined as the value of stock awards over the value of total compensation, *Option_Awards* is defined as the value of options awards over the value of total compensation, *Salary* is defined as the value of salary over the value of total compensation, and *Bonus* is defined as value of bonus over the value of total compensation.

(F) Controlled Variables

Our empirical specifications also consider some controlled variables such as other compensation components and firm characteristics that are known to be associated with financial disclosure.

Specifically, these compensation components consist of non-equity incentive plan compensation (defined as the value of non-equity incentive plan compensation over the value of total compensation), change in pension value and nonqualified deferred compensation (defined as the change in pension value and nonqualified deferred compensation over the value of total compensation), and all other compensation (defined as the value of all other compensation over the value of total compensation). Moreover, firm characteristics consist of firm size (defined as the natural logarithm of the book value of total assets), firm sales (defined as firm sales in millions), capital intensity (defined as the natural logarithm of the ratio of net property, plant, and equipment over the number of employees), leverage (defined as long-term debt plus debt in current liabilities over long-term debt plus debt in current liabilities plus the book value of common equity), and cashholding levels (defined as cash and short-term investments over net property, plant, and equipment at the beginning of the fiscal year). In order to avoid the collinearity problem when both *Size* and logarithm of *Sale*, $Ln(Sale)$ are included in our regression models we estimate the model using an instrument for *Sale* which is the residual ε_{Sale} from regressing $Ln(Sale) = \alpha + \alpha Size + \varepsilon_{Sale}$.

The correlations between our explanatory and controlled variables are approximately −0.50 to 0.55, all of which are acceptable when it comes to avoiding the problem of multi-collinearity. The detailed analysis of the correlation matrix can be found in Appendix C. Based on the above construction concepts for our explanatory variables and controlled variables, we consider that the measurements of our explanatory variables are clean from both each other and the controlled variables.

3. Empirical Specifications and Results

Here we first provide evidence that managers choose different disclosure framing for good versus bad news. We then proceed with the following empirical tests, based on empirical predictions derived from the analytical model in Appendix A.

First, we test how managers' disclosure framing choices are related to compensation structure for either good or bad news while examining how these choices are related to managerial overoptimism for different information types. Second, based on the above testing we further determine whether managers' disclosure framing choices can also signal their precommitment to certain effort levels and how these decisions are affected by managerial overoptimism for different information types. Third, after these main analyses we conduct a series of robustness tests: (i) we incorporate additional control variables for additional cross-sectional disclosure framing determinants; (ii) in order to deal with the endogeneity problem on disclosure framing and managerial effort, we use a two-stage least squares (2SLS) regression. Fourth, framing in disclosures may affect stock prices differently conditional on the underlying information type; we test whether managers' disclosure framing choices also affect underlying uncertainty differently based on the underlying information type. Fifth, we examine whether the misreporting level is related to equity-based compensation and manipulation costs, which allows us to check whether or not disclosure framing has diverse effects on misreporting results in Guttman et al. (2006).

3.1. Evidence on Different Disclosure Framing Choices for Good versus Bad News

Table 1 shows that in our 1,068 effective observations, 72% of the managers use positive framing and 28% of them use negative framing if there is good news, while for bad news 57% of the managers use positive framing versus 43% use negative framing. In Table 1 we perform a Chi-test in order to evaluate the null hypothesis that good or bad news is independent of the framing classification. The χ^2 test statistics is 20.731 and statistically significant at a 1% significant level. We can accordingly reject the null hypothesis of independence. Moreover, this table provides evidence of preponderance for positive framing in disclosing good news (i.e., delaying the release of good news) and marginally more positive framing in disclosing bad news (i.e., accelerating the release of bad news).

3.2. Disclosure Strategies, Compensation, and Overoptimism

The extant literature has shown that managers preempt the release of bad news more than that of good news (Skinner, 1994; Kasznik and Lev, 1995; Bies, 2013), delay the release of bad news (Dye and Sridhar, 1995; Acharya et al., 2011; Clark and LaBeff, 1982), or delay the disclosure of good news while simultaneously accelerating the release of bad news before options award periods (Aboody and Kasznik, 2000). In addition, Kim et al. (2021) indicate that firms with higher discre-

Table 1
Numbers and Distributions of Positive Framing and Negative Framing for Good or Bad News.

	Good News	Bad News	Total
Positive_Framing	600(72%)	136(57%)	736
Negative_Framing	229(28%)	103(43%)	332
Total	829(100%)	239(100%)	1,068

Notes: The table descirbes the numbers and distributions of positive framing versus negative framing. *Positive_Framing* and *Negative_Framing* refer to the two disclosure strategies calculated as the sign of the price difference between the stock price following the earnings forecast announcement and the stock price when the actual earnings are released where the sources of related stock returns data are from CRSP. Numbers in parentheses indicate the distributions of each disclosure strategy type for good versus bad news. We perform a Chi-test in order to examine the null hypothesis that good or bad news is independent of the positive or negative framing classification. The test statistics is 20.731 and is significant at a 1of independence.

tionary accruals that are releasing good news are more likely to announce earnings late. However, little research has addressed how managers choose their disclosure strategies, nor how these decisions are related to either managers' personal traits or companies' governance structures.

In Appendix A we provide an analytical model characterizing firms' disclosure decisions and deriving the testable predictions in detail. In order to avoid repetition we will provide the intuitions behind our results and leave detailed discussions for the appendix. Our first test examines how managerial compensation structures affect managerial disclosure strategies. We then investigate how managerial disclosure strategies are related to managerial overoptimism. The intuitions behind our theoretical results are as follows.

When equity-based compensation increases, the net benefit from using negative framing is more likely to become positive. The net benefit from using negative framing is a sum of the benefits from equity-based compensation, the implicit loss in non-equity-based compensation, and the explicit cost of price manipulation. The likelihood of choosing negative framing will accordingly increase with equity-based compensation. On the other hand, the probability of choosing positive framing will decrease with equity-based compensation. We therefore argue that the probability of using positive framing will decrease with the proportion of equity-based compensation while the probability of using negative framing will increase with the proportion of equity-based compensation. We argue that when the proportion of non-equity-based compensation increases then the probability of using negative framing will decrease. That is, managers tend to use positive framing more often as the proportion of non-equity-based compensations increases.

Based on the above discussion we predict that non-equity-based compensation will be positively related to the likelihood of using positive framing, while equity-based compensation will be positively related to the likelihood of using negative framing. Allee et al. (2021) argue that firms respond to proprietary costs by framing and structuring their disclosures. They provide evidence that product market competition is associated with an increasingly pessimistic tone and uncertainty during earnings conference calls. Moreover, as competition from the product market becomes more intense firms are more likely to emphasize the more pessimistic analysts' questions, casting their conference calls to make unfavorable questions more prominent. Our first hypothesis is different from evidence found in conference calls by Allee et al. (2021), concerning how management earnings forecasts are framed and presented as well as how these decisions are related to managerial compensation structures. We hypothesize:

Hypothesis 1a: *Non-equity-based compensation is positively associated with the likelihood of using positive framing; equity-based compensation is positively associated with the likelihood of using negative framing.*

Our second hypothesis investigates how behavioral concerns such as managerial optimism incentivize disclosure framing choices for different information types. The intuitions behind our theoretical results are as follows.

The effect of managerial overoptimism is similar to that of good news [10], i.e., the term $\alpha\lambda e^{\theta}u^{1-\theta}$[11] which measures the benefit from either increasing equity-based compensation or the implicit loss from decreasing non-equity-based compensation to a manager's payoff will be greater than $\alpha e^{\theta}u^{1-\theta}$. Given that $\alpha\lambda e^{\theta}u^{1-\theta}$ will be greater than expected for good news, when we calculate the net benefit of using negative framing the implicit loss in non-equity-based compensation will be higher with man-

[10] In the analytical model, m is defined as the mean of the distribution F for the firm's future prospects (u). We then define $u > m$ as good news and $u < m$ as bad news. When prospects are higher than expected it is good news; when it is lower than expected, it is bad news. Only the manager knows whether the future prospects are either good or bad news when the earnings forecast is disclosed.

[11] $\lambda e^{\theta}u^{1-\theta}$ denotes a firm's actual earnings as determined by the firm's prospects (u), managerial effort (e), and the manager's cognitive bias towards the future (λ). $\theta(1-\theta)$ and $0 < \theta < 1$ measures the elasticity of effort (prospects). $\lambda \geqslant 1$ indicates the manager's cognitive bias toward the future. When $\lambda > 1$ the manager is overoptimistic regarding future earnings, and when $\lambda > 1$ the manager is neutral.

agerial overoptimism. The net benefit of using negative framing is therefore less with an overoptimistic manager, and such managers should use positive framing in order to improve the net benefit from managerial overoptimism. The likelihood of using positive framing is accordingly higher with managerial overoptimism for good news.

However, for bad news $\alpha\lambda e^{\theta}u^{1-\theta}$ will be lower than expected. Managerial overoptimism will increase this term since $\alpha\lambda e^{\theta}u^{1-\theta}$ is greater than $\alpha e^{\theta}u^{1-\theta}$. The overall impact accordingly depends on the relative effects of bad news and managerial overoptimism. If the positive effect from overoptimism dominates then the implicit loss in non-equity-based compensations will be higher. The net benefit of using negative framing is therefore less with an overoptimistic manager, and the manager should use positive framing in order to increase the net benefit from managerial overoptimism. The likelihood of using positive framing is accordingly higher with managerial overoptimism. On the other hand, if bad news's negative effect dominates then the implicit loss in non-equity-based compensations will be smaller. The net benefit of increasing negative framing is higher with an overoptimistic manager, and the manager should use negative framing in order to reduce the net benefit from managerial overoptimism. The likelihood of using positive framing is consequentially lower with managerial overoptimism.

Based on the above discussion, we predict that for good news managerial overoptimism will be positively related to the likelihood of using positive framing, while for bad news managerial overoptimism will be either positively or negatively related to the disclosure framing choices. Hribar and Yang (2016) provide evidence that managerial overoptimism is positively related to the likelihood of issuing a management earnings forecast. Our second hypothesis further explores whether managerial overoptimism is associated with framing choices in management earnings forecasts for different information types. We hypothesize:

Hypothesis 1b: *For good news an overoptimistic manager is positively related to the likelihood of using positive disclosure framing, while for bad news the relation between managerial overoptimism and disclosure framing choice is uncertain.*

We test these hypotheses empirically by considering following empirical model and control for important factors that have systemic effects on cross-sectional variation in firm performance:

$$Positive\_Framing_{i,t} = \beta_0 + \beta_1 Overoptimism_{i,t} + \beta_2 GN_{i,t} \times Overoptimism_{i,t} + \beta_3' X_{i,t} + Controls_{i,t} + \varepsilon_{i,t}, \quad (1)$$

where *Positive_Framing* is an indicator variable equal to 1 when the price difference between the three-day average stock price after the announcement of management forecasts and the three-day average stock price after reporting actual EPS is negative, and 0 otherwise. *Overoptimism* is an indicator variable equal to 1 when a CEO postpones the exercise of vested options that are at least 67% in the moneyness at least twice during the sample period, and 0 otherwise. *GN* is an indicator variable equal to 1 when the difference between the (reported) actual EPS of the current year and the actual EPS for the previous year is positive, and 0 otherwise. *X* is one of the following two compensation measures:

$$Equity\text{-}Based\_Comp = Stock\_Awards + Option\_Awards$$
$$Non\text{-}Based\_Equity\_Comp = Salary + Bonus,$$

where equity-based compensation (*Equity-Based_Comp*) is based on stock price performance and includes both stock awards (*Stock_Awards*) and option awards (*Option_Awards*). Non-equity-based compensation (*Non-Based_Equity_Comp*) is based on realized earnings and includes both salaries (*Salary*) and bonuses (*Bonus*). We also control for other compensation components, such as non-equity incentive plan compensation, changes in pension value and nonqualified deferred compensation, and all other compensation. In addition we control for firm characteristics known to be associated with financial disclosure, such as firm size, firm sales, capital intensity, leverage, and cashholding levels. Robust standard errors are corrected for observation clustering at the firm level. See Appendix C for detailed variable definitions.

Tables 2 presents the regression results for the regression model (1) on disclosure strategies for good versus bad news.

3.2.1. Disclosure Framing and Compensation Structures

We present the regression results with two compensation types in Table 2. We find that the coefficient of *Equity--Based_Comp* is insignificant and *Non-Based_Equity_Comp* is significantly negative at a 5% significant level for probit regression (−0.638). We also present the regression results with more granular measures of compensation structures. We find that the coefficient of *Salary* is significantly negative at a 5% significant level for probit regression (−0.885). These results indicate that increases in the proportion of both non-equity incentive plan compensation and salary compensation will increase the incentive to use negative disclosure framing. Moreover, the coefficients for both *Stock_Awards* and *Option_Awards* are insignificant; these results indicate that both stock awards and options awards have no significant effects on disclosure framing choices. Based on these findings disclosure framing choices are affected by non-equity-based compensation but not by equity-based compensation.

Guttman et al. (2006) argue that managerial compensation is frequently related to earnings either directly or indirectly via stock prices, and managers therefore have incentive to manipulate earnings during actual earnings disclosures (mandatory disclosures). Furthermore, they predict that the level of misreporting is related to equity-based compensation. Our paper further provides theoretical and empirical illustrations, indicating that disclosure framing is an alternative way to con-

Table 2
Probit Regressions of the Choices of Disclosure Framing on Compensation Structures and Managerial Overoptimism.

	Positive_Framing		*Positive_Framing*	
	Coefficient	Z-Statistics	Coefficient	Z-Statistics
Intercept	0.406	1.29	0.532*	1.64
Overoptimism	−0.078	−0.56	−0.098	0.70
Overoptimism × *GN*	0.486***	3.52	0.481***	3.47
Equity-Based_Comp	0.058	0.62		
Non-Equity-Based_Comp	−0.638**	−2.18		
Stock_Awards			−0.112	−0.76
Option_Awards			0.236	1.35
Bonus			−0.038	−0.05
Salary			−0.885**	−2.54
Noneq_Incent	0.843***	2.56	0.835**	2.36
Pension_Chg	0.401	1.29	0.390	1.26
Othcomp	0.534	0.55	0.522	0.52
Size	0.009	0.26	0.003	0.09
ε_{Sale}	−0.117	−1.43	−0.114	−1.38
Sales Growth(*t*-1)	−0.008***	−2.74	−0.008***	−2.64
Ppeemp	−0.623	−0.86	−0.515	−0.71
Leverage	−0.465***	−2.72	−0.476***	−2.78
Cashholding	−0.010	−0.83	−0.011	−0.92
Adjusted R-Squared	0.046		0.049	
No. of Obs.	1,068		1,068	

Notes: The table present the results of regressions of disclosure strategy choices on compensation structures and managerial overoptimism. Manager's disclosure strategy choices can be either positive or negative framing. Our dummy variable *Positive-Framing* is equal to 1 if the manager's choices is positive framing. *Overoptimism* is an indicator variable equal to 1 for all years after the CEO holds options at least 67 percent in the money at least twice during the sample period, and 0 otherwise. There are two compensation groups: *Equity-Based-Comp* (*Stock-Awards, Option-Awards*) and Non-*Equity-Based-Comp* (*Salary*, *Bonus*). *GN* is equal to 1 for good news, and 0 for bad news. To avoid collinearity problem when both *Size* and Logarithm of *Sale* are included in the regression, we estimate the regression using an instrument for Sale which is the residual from regressing logarithm of *Sale* on *Size*. Z-Statistics are based on standard errors clustering by firms. *, **, and *** measure significance at the 10 percent, 5 percent, and 1 percent level, respectively.

vey information. We accordingly show that the pattern in disclosure framing is affected by executive compensation structures.

3.2.2. Disclosure Framing and Managerial Overoptimism

In Table 2 the coefficients of *Overoptimism* × *GN* are 0.486 and 0.481 respectively, and are significantly positive at a 1% significance level. The coefficients of *Overoptimism* are negative but insignificant for the probit regression. These results indicate that managerial overoptimism has no effect on framing for bad news disclosures, and an overoptimistic manager has greater incentive for using positive disclosure framing than average for good news. Since both good news and managerial overoptimism will decrease the net benefit of negative disclosure framing, managers are less likely to use negative disclosure framing. These results are consistent with Hypothesis 1b. Intuitively, for good news, managerial overoptimism will increase the incentive for using positive disclosure framing (i.e., an upward price pattern), but this effect is reduced when rational investors discount stock prices. When the positive effect of managerial overoptimism dominates then the incentive for using positive disclosure framing continues.

Hribar and Yang (2016) show that managerial overoptimism both increases the likelihood of issuing earnings forecasts and increases the amount of optimistic bias in earnings forecasts. Our study further indicates that managerial overoptimism impacts the pattern in earnings forecast disclosures and these impacts vary with the information type.

Overall, the empirical results in Table 2 show that non-equity-based compensations will enhance the incentive for negative disclosure framing for either good or bad news (i.e., accelerating the release of good news or delaying the release of bad news). Although managerial overoptimism will enhance the incentive for delaying the release of good news, the impact of managerial overoptimism on the disclosure framing choice is ambiguous for bad news.

3.3. Managerial Effort, Overoptimism, and Disclosure Framing

In Table 2 we provide evidence on the incentives that motivate disclosure framing choices. Based on these results we then further examine the pre-committed role of disclosure framing on managerial effort. Hilary et al. (2016) discuss the bright side of managerial overoptimism and show that managerial overoptimism generates high managerial effort. However, the extant literature has not yet addressed whether disclosure strategy choice and managerial overoptimism affect managerial effort differently for different information types.

Here we first provide an intuitive discussion on how the disclosure framing will affect a manager's effort decision under different information types. We then discuss how managerial overoptimism will affect a manager's effort decision under different information types. The intuitions behind our theoretical results are as follows.

Since the term $\alpha\lambda e^{\theta}u^{1-\theta}$ will be greater than expected for good news, the net benefit of increasing managerial effort is higher than expected. The manager should accordingly increase effort in order to reduce this net benefit. If positive framing is adopted then the net effect of using positive framing is negative given that the proportion of equity-based compensation approaches 1 implying that equity-based compensation levels are high. On the other hand, the net effect of using positive framing is positive given that the proportion of equity-based compensation is lower than 1. For good news the overall net effect of using positive framing and increasing effort can be either higher or lower than expected depending on the level of equity-based compensation. When the proportion of equity-based compensation approaches 1 then the overall net effect of using positive framing and increasing effort can be lower than expected. In this case the manager must decrease effort in order to increase the overall net effect and keep the manager's payoff maximization condition satisfied. However, the overall net effect of using positive framing and increasing effort can be higher than expected when the proportion of equity-based compensation is lower than 1. In this case the manager must increase effort in order to lower the overall net effect and keep the manager's payoff maximization condition satisfied.

Since the term $\alpha\lambda e^{\theta}u^{1-\theta}$ will be smaller than expected for bad news, the net benefit of increasing effort is lower than expected. The manager should therefore decrease effort in order to reduce this net benefit. If negative framing is adopted then the net effect of using negative framing is positive given that the proportion of equity-based compensations is higher than 0. On the other hand, the net effect of using negative framing is negative given that the proportion of equity-based compensations approaches 0. For bad news the overall net effect of using negative framing and increasing effort can be higher or lower than expected depending on the equity-based compensation levels. When the proportion of equity-based compensation is higher than 0 then the overall net effect of using negative framing and increasing effort can be higher than expected. In this case the manager must increase effort in order to lower the overall net effect and keep the manager's payoff maximization condition satisfied. However, the overall net effect of using negative framing and increasing effort can be lower than expected when the proportion of equity-based compensation approaches 0. In this case the manager must decrease effort in order to increase the overall net effect and keep the manager's payoff maximization condition satisfied.

Based on the above discussion we predict that for good news positive disclosure framing will either increase or decrease managerial effort levels; for bad news negative disclosure framing will either increase or decrease managerial effort levels. Black et al. (2021) discuss the committed role of managerial earnings forecasts and provide evidence that managerial earnings forecasts might commit both managers and employees into high effort levels. Our third hypothesis further explores whether or not frame choices in managerial earnings forecasts have pre-committed effects on effort levels. We hypothesize:

Hypothesis 2a: *For good or bad news, the disclosure framing choice increases managerial effort levels.*

The next hypothesis concerns the impacts of managerial overoptimism on manager effort decisions for different information types. The intuitions behind our theoretical results are as follows.

For good news the term $\alpha\lambda e^{\theta}u^{1-\theta}$ will be greater than expected, and this term is even higher if the manager is overoptimistic. The net benefit of increasing managerial effort is greater with managerial overoptimism. The manager should therefore increase effort levels in order to reduce the net benefit of managerial overoptimism.

For bad news the term $\alpha\lambda e^{\theta}u^{1-\theta}$ will be lower than expected, but this term will be higher if the manager is overoptimistic. The overall impact accordingly depends on the relative effects of bad news and managerial overoptimism. If the negative effect from bad news dominates then the overall benefit will decrease and managers must decrease effort levels in order to improve the benefit of managerial overoptimism. Alternatively, if the positive effect from managerial overoptimism dominates then the overall benefit will increase and managers must increase effort in order to reduce the benefit of managerial overoptimism.

Based on the above discussion we predict that for good news managerial overoptimism will increase managerial effort levels; for bad news, managerial overoptimism will either increase or decrease managerial effort levels. Hilary et al. (2016) indicate that managers who have experienced recent successes are more likely to issue overoptimistic forecasts. Moreover, they find that these managers appear to exert greater effort in order to meet their over-optimistic forecasts. Different from Hilary et al. (2016), our study argues that both the framing choices for management earnings forecasts and managerial overoptimism may motivate managers to generate higher effort levels. Our fourth hypothesis further explores the bright side of managerial overoptimism for different information types. We hypothesize:

Hypothesis 2b: *For good news managerial overoptimism increases managerial effort levels; for bad news managerial overoptimism increases or decreases managerial effort levels.*

We test theses hypotheses empirically by considering following the empirical model and control for important factors that have systemic effects on the cross-sectional variation in firm performance:

$$\begin{aligned} Managerial\_Effort_{i,t} = {} & \beta_0 + \beta_1 Overoptimism_{i,t} + \beta_2 GN_{i,t} \times Overoptimism_{i,t} + \beta_3 Positive\_Framing_{i,t} + \beta_4 GN_{i,t} \\ & \times Positive\_Framing_{i,t} + \beta_5' X_{i,t} + Controls_{i,t} + \varepsilon_{i,t}, \end{aligned} \tag{2}$$

where *Managerial_Efforts* is sales growth as a proxy for managerial effort levels. We consider the same group of controlled variables as in equation (1). Robust standard errors are corrected for observation clustering at the firm level. Table 3 presents the results for the regression model (2) on managers' effort decisions.

Table 3
OLS Regressions of Managerial Effort on Disclosure framing and Managerial Overoptimism.

	Managerial_Effort	
	Coefficient	t-Statistics
Intercept	10.389***	3.47
Overoptimism	−3.660	−2.22
Overoptimism × *GN*	6.354***	3.57
Positive_Framing	−4.415***	−3.01
Positive_Framing × *GN*	7.579***	4.67
Equity-Based_Comp	−0.457	−1.23
Non-Equity-Based_Comp	−4.986*	−1.70
Noneq_Incent	8.950**	2.43
Pension_Chg	−0.869	−0.46
Othcomp	0.630	0.08
Size	−0.627*	−1.83
ε_{Sale}	−8.890***	−6.71
Sales Growth(*t*-1)	0.206***	5.55
Ppeemp	−16.392	−1.09
Leverage	−1.964	−1.26
Cashholding	−0.038	−0.31
Adjusted R-Squared	0.308	
No.of Obs.	1,068	

Notes: The table present the results of regressions of managers' effort level on disclosure strategy choices and managerial overoptimism. We measure managers' effort levles by sales growth since effort is a crucial determinat for gorowth. *Positive- Framing* is equal to 1 if the manager's choices is positive framing. *Overoptimism* is an indicator variable equal to 1 for all years after the CEO holds options at least 67 percent in the money at least twice during the sample period, and 0 otherwise. There are two compensation groups: *Equity-Based-Comp* (*Stock-Awards*, *Option-Awards*) and *Non-Equity-Based-Comp* (*Salary*, *Bonus*). *GN* is equal to 1 for good news, and 0 for bad news. To avoid collinearity problem when both *Size* and Logarithm of *Sale* are included in the regression, we estimate the regression using an instrument for *Sale* which is the residual from regressing logarithm of *Sale* on *Size*. t-Statistics are based on standard errors clustering by firms. *, **, and *** measure significance at the 10 percent, 5 percent, and 1 percent level, respectively.

3.3.1. Managers' Effort Decisions and Disclosure Framing

In Table 3 the coefficient of *Positive_Framing* × *GN* is significantly positive at a 1% significant level for the OLS regressions (7.579) and the coefficient of *Positive_Framing* is significantly negative at a 1% significant level for the OLS regressions (−4.415).These results show that using positive disclosure framing has a positive effect on managerial efforts for good news, while using positive disclosure framing has a negative effect on managerial effort for bad news where the positive effect of using positive disclosure framing for good news is strengthened compared to the negative effect of using positive disclosure framing for bad news.

The explanation of our findings is as follows. For good news the firm's earnings increase such that a rational manager would choose positive disclosure framing (i.e., an upward price pattern) as a pre-commitment to a higher effort level. However, the firm's earnings decrease for bad news which will counteract the positive effect of pre-committed disclosure framing on effort levels. The net effect of disclosure framing will accordingly be negative when the former effect dominates the latter. Our findings are also consistent with Skinner (1997); Rogers and Stocken, (2005); Lee et al., (2012); and Otomasa et al., (2020) arguing that the first annual earnings forecast demonstrates a pre-commitment from management. Our study further indicates that the pre-commitment effect of managerial earnings forecasts varies with different information types.

3.3.2. Managers' Effort Decisions and Overoptimism

In Table 3 the coefficient of *Overoptimism* × *GN* is significantly positive at a 1% significant level for the OLS regressions (6.354) while the coefficient of *Overoptimism* is significantly negative at a 5% significant level for the OLS regressions (−3.660). These results show that for good news, managerial overoptimism has a positive effect on managerial effort. However, for bad news managerial overoptimism has a negative effect on managerial efforts where the positive effect of managerial overoptimism for good news is stronger than the negative effect of managerial overoptimism for bad news.

The intuition of these findings is as follows. Managerial overoptimism makes the firm's future earnings overestimated. The optimistic manager will accordingly increase effort levels in order to produce higher earnings for good news. However, for bad news the firm's earnings decrease and counteract the positive effect of managerial overoptimism on effort levels. When the former effect dominates the latter effect then the net effect of managerial overoptimism will be negative. Hilary et al. (2016) discuss the bright side of managerial overoptimism and show that managerial overoptimism generates high managerial effort. Based on this literature we further examine whether disclosure strategy choice and managerial overoptimism affect managerial effort differently for different information types. Hilary et al. (2016) find the positive effects of managerial overoptimism on managerial effort. Our study further indicates that this positive effect varies with different information types.

Overall the empirical results in Table 3 show that managers' efforts increase with the possibility of using positive disclosure framing and managerial overoptimism for good news. However, for bad news either managerial overoptimism or positive framing have adverse effects on managerial effort.

4. Robustness Checks

This section modifies Table 2 in order to check the robustness after including additional disclosure framing determinants such as investor sentiment. We also modify Table 3 and consider another robustness check controlling for endogeneity using a two-stage least squares (2SLS) estimation.

4.1. Controlling for Investor Sentiment

The prior literature indicates that managers strategically vary their voluntary disclosure policies in response to prevailing investor sentiment (Bergman and Roychowdhury, 2008). We examine the robustness of our results to this cross-sectional effect by incorporating *Sent*1 (or *Sent*2), as well as interacting *GN* with *Sent*1 (or *Sent*2) as additional controls to our regression (1). *Sent*1 and *Sent*2 denote two investor sentiment proxies advanced by Baker and Wurgler (2006). These sentiment indexes are based on the first principal component of the correlation matrix for five variables: the dividend premium, the number and average first-day returns on IPOs, the close-end fund discount, and the equity share in new issues.[12]

In Table 4 we find that the magnitude of the coefficients and statistical significance for the variables $Overoptimism \times GN$ and $Nonequity - Based\_Awards$ remain largely similar to Table 2 for the parsimonious model. The coefficients on $Overoptimism \times GN$ are 0.629 with a z-statistic of 4.14 and 0.544 with a z-statistic of 3.12. Moreover, the coefficients on $Nonequity - based\_awards$ are −0.865 with a z-statistic of −2.88 and −0.931 with a z-statistic of −3.11. Both the coefficients of $Sent1 \times GN$ and $Sent2 \times GN$ are insignificant and both the coefficients of *Sent*1 and *Sent*2 are significantly negative at a 1% significant level for the Probit regression where the coefficients are −1.307 and −1.405 respectively. These results indicate that managers are incentivized to use negative disclosure framing for either good or bad news when investor sentiment is high.

4.2. Two-Stage Least Squares (2SLS) Regressions

We deal with the endogeneity problem on disclosure framing and managerial efforts.Notice thatwhen management forecasts are announced the managers can signal their information concerning the firm's prospects and their pre-commit to some effort levels. Both managerial choices of disclosure framing and managerial effort choices are endogenous in the analytical model. In our empirical testing we use sales growth to measure managerial effort choices in which the disclosure framing affects effort choice, but managerial effort choices cannot affect disclosure framing choices. The details of the measurement of managerial effort are referred to in point (A) of Section 2. We use a two-stage least squares (2SLS) regression in order to conduct the potential endogeneity problem which proceeds as follows. We consider the following three instrument variables:

(1) *Loss* is 1 if a firm's current earnings are negative, and 0 otherwise. Ajinkya et al. (2005) and Baik et al. (2011) find a negative relation between loss firms and management earnings forecasts.
(2) *AnalystsFollowing* is the number of analysts following the firm during the current year. Lang and Lundholm (1996); Ajinkya et al. (2005); and Baik et al. (2011) find a positive relation between analyst following and management disclosures.
(3) *Sent*1 is the investor sentiment index based on Baker and Wurgler (2006). In addition, Bergman and Roychowdhury (2008) and Kim et al. (2016) show that managers strategically react to investor sentiment in their disclosure policies.

In Stage 1 we incorporate these three instrument variables into the regression model (1') and run this regression model:

$$\begin{aligned} Positive\_Framing_{i,t} = {} & \beta_0 + \beta_1 Overoptimism_{i,t} + \beta_2 GN_{i,t} \times Overoptimism_{i,t} + \beta_3' X_{i,t} + \beta_4 Loss_{i,t} \\ & + \beta_5 AnalystsFollowing_{i,t} + \beta_6 Sent1_{i,t} + Controls_{i,t} + \epsilon_{i,t}. \end{aligned} \quad (1')$$

By estimating (1') we then calculate the fitted value of *Positive_Framing*, "*PositiveFraming*". In Stage 2 we add the term *PositiveFraming* into the regression model (2), which now becomes model (2'):

[12] We obtained the investor sentiment measures from Jeffrey Wrugler's website (http://pages.stern.nyu.edu/~jwurgler/) and the sentiment index is measured annually. Note that *Sent*1 is based on the first principal component of five (standardized) sentiment proxies. Each proxy has first been orthogonalized with respect to a set of six macroeconomic indicators including industrial production index, nominal durables consumption, nominal nondurables consumption, nominal services consumption, NBER recession indicator, employment, and consumer price index. *Sent*2 is based on the first principal component of five (standardized) sentiment proxies.

Table 4
Probit Regressions of Disclosure Framing Choices on Compensation Structures and Managerial Overoptimism: Incorporating Investor Sentiment.

	Positive_Framing		*Positive_Framing*	
	Coefficient	Z-Statistics	Coefficient	Z-Statistics
Intercept	0.299	0.94	0.052	0.16
Overoptimism	−0.192	−1.29	−0.104	−0.66
Overoptimism × *GN*	0.629***	4.14	0.544***	3.12
Sent1	−1.307***	−4.00		
Sent1 × *GN*	−0.380	1.01		
Sent2			−1.405***	−3.96
Sent2 × *GN*			−0.110	−0.30
Equity-Based_Comp	0.049	0.51	0.048	0.50
Non-Equity-Based_Comp	−0.865***	−2.88	−0.931***	−3.11
Noneq_Incent	0.740**	2.22	0.755**	2.27
Pension_Chg	0.283	0.95	0.252	0.87
Othcomp	0.733	0.75	0.653	0.69
Size	0.015	0.44	0.013	0.38
ε_{Sale}	−0.120	−1.45	−0.133	−1.60
Sales Growth(*t*-1)	−0.007**	−2.26	−0.009***	−3.02
Ppeemp	−0.737	−1.00	−0.728	−0.99
Leverage	−0.433**	−2.51	−0.406**	−2.35
Cashholding	−0.011	−0.97	−0.010	−0.85
Adjusted R-Squared	0.075		0.073	
No. of Obs.	1,068		1,068	

Notes: The table present the results of regressions of disclosure strategy choices on compensation structures and managerial overoptimism with controlling for investor sentiment. Manager's disclosure strategy choices can be either positive or negative framing. Our dummy variable *Positive-Framing* is equal to 1 if the manager's choices is positive framing. *Overoptimism* is an indicator variable equal to 1 for all years after the CEO holds options at least 67 percent in the money at least twice during the sample period, and 0 otherwise. There are two compensation groups: *Equity-Based-Comp* (*Stock-Awards*, *Option-Awards*) and *Non-Equity-Based-Comp* (*Salary*, *Bonus*). Sent is either *Sent1* or *Sent2* which denote two investor sentiment proxies advanced by Baker and Wurgler (2006). The sentiment indexes are based on the first principal component of the correlation matrix of five variables: the dividend premium, the number and average first-day returns on IPOs, close-end fund discount, and equity share in new issues. *GN* is equal to 1 for good news, and 0 for bad news. To avoid collinearity problem when both *Size* and logarithm of *Sale* are included in the regression, we estimate the regression using an instrument for *Sale* which is the residual from regressing logarithm of *Sale* on *Size*. Z-Statistics are based on standard errors clustering by firms. *, **, and *** measure significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Table 5
Two-Stage Regression of Managerial Effort on Disclosure Framing and Managerial Overoptimism.

	Positive_Framing		*Managerial_Effort*	
	Coefficient	Z-Statistics	Coefficient	t-Statistics
Intercept	0.264	0.71	12.477***	3.79
Overoptimism	−0.130	−0.81	−2.871*	−1.75
Overoptimism × *GN*	0.585***	3.69	5.822***	3.17
Positive_Framing			−6.930***	−3.48
PositiveFraming × *GN*			8.006***	4.18
Equity-Based_Comp	0.049	0.51	−0.408	−0.37
Non-Equity-Based_Comp	−0.865***	−2.88	−3.941	−1.27
Noneq_Incent	0.907**	2.43	1.863*	1.86
Pension_Chg	0.276	0.84	−0.413	−0.19
Othcomp	0.960	0.91	−2.353	−0.30
Size	0.065	1.53	−0.717**	−2.22
ε_{Sale}	−0.020	−0.22	−8.579***	−10.74
Sales Growth(*t*-1)	−0.007**	−1.99	0.250***	8.64
Ppeemp	−0.193	−0.25	−19.762***	−2.79
Leverage	−0.428**	−2.36	−1.193	−0.72
Cashholding	−0.007	−0.59	−0.071	−0.62
Loss	−0.174*	−1.81		
AnalystFollowing	−0.004***	−3.17		
Sent1	−0.912***	−3.11		
Adjusted R-Squared	0.081		0.325	
No. of Obs.	915		915	

Notes: The table presents the results of a two-stage regression for effects of both disclosure strategy choices and managerial overoptimism on managerial effort. We consider the following three instrucment variables: (i) *Loss* is 1 if a firm's current earnings is negative, and 0 otherwise; (ii) *AnalystsFollowing* is the number of analysts following the firm during the current year; (iii) *Sent1* is investor sentiment. In Stage 1, we incorporate these three instrument variables into the regressions of disclosure strategy choices on compensation structures and managerial overoptimism. We then calculate the fitted value of *Positive-Framing* (*PositiveFraming*). In Stage 2, we add the term (*PositiveFraming*) into the regressions of managers' effort levels on disclosure strategy choices and managerial overoptimism. t-statistics are based on standard errors clustering by firms. *, **, and *** measure significance at the 10 percent, 5 percent, and 1 percent level respectively.

$$Managerial\_Effort_{i,t} = \gamma_0 + \gamma_1 Overoptimism_{i,t} + \gamma_2 GN_{i,t} \times Overoptimism_{i,t} + \gamma_3 PositiveFraming_{i,t} + \gamma_4 GN_{i,t} \times PositiveFraming_{i,t} + \gamma_5' X_{i,t} + Controls_{i,t} + \varepsilon_{i,t}. \quad (2')$$

Table 5 presents the 2SLS regression results for managers' disclosure choices. We found that the coefficients on *Loss*, *AnalystsFollowing*, and *Sent*1 are significantly negative, indicating that our instruments are negatively correlated with managers' propensity for choosing positive framing as disclosure strategies. The coefficient of $GN \times PositiveFraming$ (8.006) is positive at a 1% significance level and $PositiveFraming$ (−6.930) is negative at a 1% significance level. These results suggest that managers use positive framing in disclosures as pre-commitment for good news in order to exert greater effort levels, but for bad news positive framing has an adverse effect on managerial efforts. The coefficient of $GN \times Overoptimism$ (5.822) is significantly positive at a 5% significant level and the coefficient of $Overoptimism$(−2.871) is significantly positive at a 10% significant level. These results suggest that managers' efforts associated with good news announcements are driven by managerial overoptimism, but for bad news managerial overoptimism negatively affects managerial efforts. Overall our empirical results on the relation between managerial efforts and managerial overoptimism as well as the relation between managerial efforts and disclosure strategies also hold in a 2SLS estimation.

5. Further Analysis

5.1. Stock Return Volatility, Overoptimism, and Disclosure Framing

We have shown that framing in disclosures has a different pattern conditional on the underlying information types. We want to investigate further how disclosure framing can also affect underlying uncertainty differently based on the underlying type of information. The consulting company McKinsey (Hsieh et al., 2006) point out that:

> *Many executives believe that providing earnings guidance helps them to maintain an open channel of communication with investors in their companies and to increase the visibility of those companies while reducing the volatility of share prices and improving share valuations.*

Managers accordingly tend to believe that voluntary disclosure reduces stock volatility. Furthermore, the extant literature documents that investors overreact to bad news relative to good news (Veronesi, 1999; Bekaert and Wu, 2000. Bekaert and Wu, 2000) provide evidence that market-level news can create volatility feedback loops, where bad news exacerbates price responses through leverage and volatility effects, while good news dampens price responses. Piotroski (2002) examines the impact of management forecasts on short-term stock return volatility, finding that the average management forecast is followed by heightened volatility during the fifteen days following the traditional announcement window.

Based on the extant studies and our previous findings we argue that disclosure framing is an alternative channel for firm communication with investors and increasing visibility while reducing share price volatility. We accordingly expect that positive disclosure framing will dampen stock price volatility for good versus bad news. We test this empirically by choosing stock return volatility as the underlying construct of interest.

Although both stock price volatility and cash flow volatility can be used to measure underlying uncertainty, cash flow volatility is inappropriate while stock price volatility is a better measure for our construct of interest. First, based on the above literature disclosures can affect stock price changes by influencing investors' pricing. Second, cash flows from operations are equal to current-period earnings level minus current-period accruals. Alternatively, cash flows from operations can be expressed as a function of current-period sales and last-period sales (Dechow et al., 1998). Managers therefore cannot directly affect changes in cash flows via disclosure, while they can put their efforts into producing smooth cash flows that add value (Rountree et al., 2008). We hypothesize:

Hypothesis 3: *For good or bad news positive framing is negatively related to stock return volatility increases and this effect is more strengthened for good news.*

We test this hypothesis empirically by considering the following model and controlling for important factors that have systemic effects on cross-sectional variation in firm performance:

$$Stock\_Volatility_{i,t} = \beta_0 + \beta_1 Overoptimism_{i,t} + \beta_2 Overoptimism_{i,t} \times GN + \beta_3 Positive\_Framing_{i,t} + \beta_4 Positive\_Framing_{i,t} \times GN + \beta_5' X_{i,t} + Controls_{i,t} + \epsilon_{i,t}, \quad (3)$$

where *Stock_Volatility* is the standard deviation of daily stock returns over the fiscal year expressed in percentage terms. We consider the same group of controlled variables as in Eq. (1). Robust standard errors are corrected for observation clustering at the firm level.

We present the empirical results in Table 6. In Table 6 the coefficient of $Positive\_Framing \times GN$ is significantly negative at a 1% significant level for the OLS regressions (−0.003), and the coefficient of *Positive_Framing* is significantly negative at a 10% significant level for the OLS regressions (−0.002). These results indicate that positive disclosure framing is negatively associated with stock return volatility, and this is stronger for good news. This evidence suggests that investors have greater confidence in positive disclosure framing for good versus bad news..

Table 6
OLS Regression of Disclosure Framing on Stock Return Volatility.

	Stock_Volatility	
	Coefficient	t-Statistics
Intercept	0.037***	16.42
Overoptimism	0.000	0.16
Overoptimism × *GN*	0.000	0.26
Positive_Framing	−0.002*	−1.87
Positive_Framing × *GN*	−0.003***	−3.68
Equity-Based_Comp	0.003	1.23
Non-Equity-Based_Comp	0.006***	2.66
Noneq_Incent	0.006**	2.09
Pension_Chg	−0.002	−1.28
Othcomp	0.003	0.33
Size	−0.002***	−9.01
ε_{Sale}	−0.000	−0.04
Sales Growth(*t*-1)	0.000	1.12
Ppeemp	0.006	1.10
Leverage	−0.002	−1.50
Cashholding	0.000*	1.78
Adjusted R-Squared	0.287	
No. of Obs.	1,068	

Notes: The table present the results of regressions of stock return volatility on disclosure strategy choices and managerial overoptimism. Stock Volatility is the standard deviation of daily stock returns over the fiscal year. The choices of disclosure framie can be either positive or negative framing. Our dummy variable *Positive-Framing* is equal to 1 if the manager's choices is positive framing. *Overoptimism* is an indicator variable equal to 1 for all years after the CEO holds options at least 67 percent in the money at least twice during the sample period, and 0 otherwise. There are two compensation groups: *Equity-Based-Comp* (*Stock-Awards*, *Option-Awards*) and *Non-Equity-Based-Comp* (*Salary*, *Bonus*). *GN* is equal to 1 for good news, and 0 for bad news. To avoid collinearity problem when both *Size* and Logarithm of *Sale* are included in the regression, we estimate the regression using an instrument for *Sale* which is the residual from regressing logarithm of *Sale* on *Size*. t-Statistics are based on standard errors clustering by firms. *, **, and *** measure significance at the 10 percent, 5 percent, and 1 percent level, respectively.

5.2. Misreporting, Equity-Based Compensation, and Internal Control

The separating equilibrium of Guttman et al. (2006) suggests that the difference $(x^R - x)$ will be related to equity-related compensations as well as manipulation costs. Therefore, based on Guttman et al. (2006) empirical prediction, we examine whether the level of misreporting is related to equity-related compensations and manipulation costs allowing us to determine whether or not disclosure framing alters the misreporting results in Guttman et al. (2006).

We examine these relationships using an OLS regression model:

$$Misreporting_{i,t} = \beta_0 + \beta_1 Equity\text{-}Based\_Comp_{i,t} + \beta_2 Weak_{i,t} + \beta_3 Ppeemp_{i,t} + \beta_4 \text{Size}_{i,t} + \beta_5 Leverage_{i,t} + \beta_6 Loss_{i,t} + \epsilon_{i,t}, \quad (4)$$

where *Misreporting* denotes the misreporting levels and is measured as the absolute value of the difference between the management forecasts and the reporting of actual EPS. *Equity-Based_Comp* consist of *Stock_Awards* and *Option_Awards*. *Weak* represents the internal control quality and is an indicator variable equal to 1 if the firm disclosed a material weakness during our sample period, and 0 otherwise.[13] Chan et al. (2008) find strong evidence of earnings management in firms with less auditable material weaknesses. Similarly, Feng et al. (2009) find that firms with material internal control weaknesses are more likely to provide forecasts with significant errors. Hribar and Yang (2016) show that a firm reporting a material weakness during the sample period is more likely to give an optimistic bias in forecasts. We also control for firm characteristics known to be associated with financial misreporting, such as capital intensity (*Ppeemp*), firm size (*Size*), leverage (*Leverage*), and an indicator for reporting loss (*Loss*). Robust standard errors are corrected for observation clustering at the firm level.

In Table 7 the coefficient of either *Equity* − *Based_Awards* or *Weak* is insignificant for the OLS regression. However, the coefficient of *Ppeemp* is significantly positive at a 1% significant level for the OLS regressions (71.379). These results indicate that capital intensity positively affects misreporting as well as that misreporting is not motivated by equity-based compensation. This implies that managerial compensation is not frequently related to earnings via stock prices so that managers have fewer incentives to manipulate earnings.

The takeaway points from these results are the following. First, the results in Table 2 and Table 7 indicate that equity-based compensation is not used to motivate management in financial reporting (misreporting). Second, unlike Guttman et al. (2006), our theoretical model shows that managerial overoptimism and executive compensation structures motivate managers not only in disclosure framing $(P(x^R) - P(x))$ but also in effort allocation. The difference between $(x^R) - (x)$ and $(P(x^R) - P(x))$ is that $P(x^R)$ is defined as $E(x|x^R)$. Expectations concerning the actual earnings are determined by both a firm's

[13] The data are from Audit Analytics.

Table 7
OLS Regression of Misreporting on Equity-Based Compensation and Internal Control.

	Misreporting	
	Coefficient	t-Statistics
Intercept	4.964	0.52
Equity-Based_Comp	−1.712	−0.41
Weak	−2.723	−0.23
Ppeemp	71.379***	2.76
Size	−0.310	−0.26
Leverage	0.099	0.01
Loss	−5.669	−1.54
Adjusted R-Squared	0.01	
No. of Obs.	758	

Notes: The table present the results of regressions of misreporting on equity-based compensation and internal control. *Misreporting* denotes the misreporting levels and is measured as the absolute value of difference between the management forecasts and the reporting of actual EPS. *Equity-based-Comp* consists of *Stock-Awards* and *Option-Awards*. *Weak* represents the internal control quality and is an indicaotr variable equal to 1 if the firm disclosed a material weakness during our sample period and 0, otherwise. We also control for firm characteristics known to be associated with financial reporting, such as capital intensity (*Ppeemp*), firm size (*Size*), leverage (*Leverage*), and an indicaotr for reporting loss (*Loss*). t-Statistics are based on standard errors clustering by firms. *, **, and *** measure significance at the 10 percent, 5 percent, and 1 percent level, respectively.

prospects (μ) and managerial effort. x^R not only signals the firm's prospects but also signals the managerial effort. Since $(P(x^R) - P(x))$ is related to the expectation it allows us to investigate the effects of behavioral concerns such as managerial optimism and information type. Our empirical results in Tables 2 and 3 confirm that both disclosure framing and effort allocation are related to managerial overoptimism, the type of news (good or bad), and non-equity-related compensation. These pieces of evidence suggest that both disclosure framing and effort decisions alter the misreporting results in Guttman et al. (2006) such that managers are motivated by either behavioral concerns (managerial optimism) or corporate governance structures (non-equity-related compensations) to convey information via disclosure framing.

6. Concluding Remarks

We have studied how managers strategically choose the best framework for delivering earnings forecast announcements under either good or bad news. We consider two disclosure choices: positive or negative framing for the good or bad news respectively. We use a simple model in order to characterize various strategic concerns behind these disclosure framing choices. Intuitively, manipulating the disclosure frame has three main effects on managerial compensations: equity-based award benefits, implicit loss in non-equity-based awards, and explicit manipulation costs. Managers' incentives to manipulate disclosure frames are accordingly affected by the compensation structures that combine these three terms in addition to information type, managerial overoptimism, and managers' efforts.

By investigating a sample of company-issued guidance data from Thomson Reuters I/B/E/S for the period from 2009 to 2017, our empirical results support most of these analytical predictions which are summarized as follows.

(i) **Disclosure Framing Choices**: When the proportion of non-equity-based awards increases, managers are more likely to use negative disclosure framing. However, managerial "overoptimism" increases the probability of using positive disclosure framing for good news.

(ii) **Disclosure Framing and Managerial Effort**: For good news managers' effort levels increase with the probability of using positive disclosure framing where there is also managerial overoptimism. For bad news the effects of positive disclosure framing and overoptimism on managers' effort levels are both negative.

(iii) **Disclosure Framing and Stock Return Volatility**: For either good or bad news, using positive disclosure framing leads to low stock return volatility, which is more strengthened under good news. The evidence from this test also generally suggests that investors have greater confidence in management forecasts for good news versus bad news.

(iv) **Misreporting, Equity-Based Compensation, and Internal Control**: Our empirical results indicate that misreporting levels are unrelated to either equity-based awards or internal control quality, but are positively related to capital intensity. The evidence from this test suggests that managerial compensation is not frequently related to earnings via stock prices and that managers have fewer incentives to manipulate earnings. The results in both (i) and (iv) suggest that equity-based compensation is not used to motivate management during financial reporting (misreporting). However, the results in both (i) and (ii) further indicate that both disclosure framing and effort allocation depend on managerial overoptimism, the type of news (good or bad), and non-equity-related compensation. These indicate that disclosure framing and effort allocation alter the misreporting results found in Guttman et al. (2006). Furthermore, managers are motivated by either behavioral concerns (managerial optimism) or corporate governance structures (non-equity-related compensations) when conveying information via disclosure framing.In our analytical model managers consider the trade-off between various incentives, such as executives' compensation structures, information type, and managerial overoptimism, when determining disclosure framing and effort allocation. The model predic-

tions also reflect managers' trade-offs in choosing between disclosure framing and effort allocation. The trade-off between various incentives versus disclosure framing and effort allocation may not be tested directly. The causal inference between disclosure framing and effort has been further discussed using a two-stage least squares (2SLS) estimation. However, the interaction among various incentives is still left to resolve. The results in (i) and (ii) may accordingly beg the question regarding the trade-off among various incentives; this is an important caveat of our study. Some studies have developed and estimated structural models that connect the well-known facts based on stylized economic models and strong assumptions concerning economic behavior. Structural models can be designed to further test and interpret these economic trade-offs (Gow et al., 2016). Further research is worthy of testing these managerial trade-offs via structural approaches.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Analytical Model

We consider a simple signaling model in which a privately informed manager issues an earnings forecast in order to signal his or her information concerning the firm's prospects as well as a pre-committed effort level, and public investors subsequently determine the stock price based on public information provided by the manager. Our model is an adaptation of Guttman et al. (2006), which provides a nice linkage between management earnings forecasts and stock price. However, due to agency problems managers' earnings forecasts will affect the levels of actual earnings, which in turn can have an impact on managers' efforts. In order to incorporate the interactions among forecasts, effort, and actual earnings we consider a more realistic executive compensation including both equity-based awards and performance bonuses (Ellig, 2001). Executive compensation is assumed as a weighted sum of equity-based awards and performance bonuses so that we can discuss the disclosure strategy choices and managerial efforts, as well as their relationship to compensation structures and managerial overoptimism.

We consider a three-stage signaling model with a privately informed manager and numerous investors. The manager is privately informed of the firm's prospects (u), which together with the manager's effort will determine the firm's actual earnings. At $t = 1$ the manager issues an earnings forecast (x^R) and pre-commits to an effort level (e). At $t = 2$ the investors observe the forecast, calculate the expected earnings, and modify the stock price accordingly.The manager's effort decision is not observable by public investors. At $t = 3$, u is realized; the firm's actual earnings are subsequently released and publicized. Public investors observe the actual earnings and modify the stock price accordingly. More details regarding earnings and the information structure are given as follows.

A.1. Incomplete Information on Prospects and Effort

The actual earnings are determined by two elements: the firm's prospects (u) and managerial effort ($e \in [0, 1]$).[14] Other inputs such as capital and labor are assumed to be publicly observable, and we use a constant K to summarize the overall impacts from these inputs. Since no private information is contained in K, there is no loss of generality to assume that $K = 1$. Specifically, the actual earnings $x$are assumed as a function of the firm's prospects and effort as follows:

$$x(e, u) = \lambda e^{\theta} u^{1-\theta},$$

where $0 < \theta < 1$ $(1 - \theta)$ measures the output elasticity of effort (prospects). The Cobb-Douglas function is assumed because it provides tractable solutions, as well as having a property where the effort's marginal production increases with the prospects level. When the prospects are low, the manager must exert more effort in order to reach the same level of earnings as when the prospects are high. This property will reinforce the incentive of the performance bonus in managerial compensation.

We use an exogenously given parameter $\lambda \geqslant 1$ in order to indicate the manager's cognitive bias toward the future. When $\lambda > 1$ the manager is overoptimistic about future earnings, while when $\lambda = 1$ the manager is neutral.

Next both the firm's prospects and the manager's effort decision are privately known by the manager. The uninformed public investors have a prior belief that e is uniformly distributed over $[0, 1]$, and that u is drawn from a normal distribution[15] with mean m and variance σ^2. The cumulative distribution function is F, and the density function is denoted by f. All other parameters and functional forms of these distributions are common knowledge.

[14] Note that managers' effort decisions are endogenously determined in our model. This setting is different from the literature, which attributes the exogenous CEO-specific characteristic of ability as an important factor in determining the likelihood and frequency of issuing a forecast (see Trueman, 1986; Aboody and Kasznik, 2000; Nagar et al., 2003; Cheng and Lo, 2006).

[15] We have followed Fischer and Verrecchia (2004) and Guttman et al. (2006) in making this assumption.

Public investors adjust their beliefs, expectations about earnings, and the stock price according to the public information released by the firm. There are two sources of public information in this signaling process: the manager's earnings forecast (x^R) announced at $t = 1$, and the actual earnings (x) publicized at$t = 3$.

First, after observing x^R investors adjust their prior beliefs and let $F(x|x^R)$ and $f(x|x^R)$ denote the posterior cumulative and density functions, while $E(x|x^R)$ is the posterior expected earnings. Following Guttman et al. (2006) we assume the following pricing function which maps the set of management forecast into the set of stock price: $P : R \to R$. The stock price after observing x^R is:

$$P(x^R) = E(x|x^R). \tag{A.1}$$

Numerous investors will dilute any arbitrage benefit and the stock price accordingly reflects the expected earnings. Waymire (1984) and Ajinkya and Gift (1984) show positive stock price reactions to management forecasts of earnings increase and negative reactions to forecasts of earnings decrease.

Second, when the actual earnings are publicized at $t = 3$ there is no uncertainty so that $P(x) = x$.

A.2. Manager's Payoff

The manager's payoff $U(x(e,u),\ x^R)$ is the managerial compensation minus the effort and price manipulation costs. In order to incorporate the interaction between forecasts, effort, and actual earnings we consider executive compensation consisting of equity-based awards and performance bonuses (Ellig, 2001). Specifically, managerial compensation is a weighted sum of equity-based awards and performance bonuses; let $0 < \alpha < 1$ denote the proportion on equity-based awards. Then:

$$U(x(e,u),x^R) = \alpha\left(\frac{P(x)+P(x^R)}{2}\right) + (1-\alpha)(x - E(x|x^R)) - \frac{e^2}{2} - \beta\frac{(E(x|x^R)-x)^2}{2}. \tag{A.2}$$

The first two terms represent managerial compensation, while the last two terms are the effort and manipulation costs. First, since the stock price is positively related to stockholders' returns we use the period-average stock price ($\frac{P(x)+P(x^R)}{2}$) to measure this term. Most large firms compensate their top executives through stock options, which now represent the largest single component of managerial pay (Murphy, 1999; Kanagaretnam et al., 2004). Baik et al. (2011) conclude that a forecast release will lead to a higher firm value at the end of the period than if the forecast had not been issued, enhancing the manager's equity-based wealth.

Second, a performance bonus is rewarded according to the difference between actual and expected earnings; that is, managers endeavor to improve the firm's earnings. In business practices a predetermined performance bonus for meeting a specific goal or target is common in the sales industry as well as for C-suite executives at large companies.[16]

Third, the effort cost measures the manager's direct or opportunity cost involved in producing the earnings report. The manipulation cost represents the manager's legal, regulatory, or psychic costs, increasing with the forecast dispersion (see Guttman et al., 2006). The quadratic functions of these two cost terms are assumed so that the manager's objective function will be concave and the discussion on the manager's optimization problem is meaningful.

A.3. Equilibrium

We look for the perfect Bayesian equilibria of this game, including a disclosure strategy, an effort decision, and the investors' belief updating process.

Let $\rho : [0,1] \times R \to R$ with $\rho(x(e,u)) = x^R$ denoting the manager's disclosure strategy which maps the actual earnings to the management forecast. When announcing x^R the manager must pre-commit to an effort level. Let $\delta : R \to [0,1]$ with $\delta(u) = e$ denoting the manager's effort decision, which is a real function mapping the prospects to the effort level. A perfect Bayesian equilibrium is a pair of strategies (ρ, δ) together with investors' posterior beliefs that satisfies the following conditions:

(i) For all u, $(\rho(x(e,u),\delta(u)) \in \arg\max_{x^R,\ e} U(x(e,u),x^R)$;
(ii) The posterior beliefs $F(x|x^R)$ and $f(x|x^R)$ are consistent with the disclosure strategy by Bayes' rule wherever possible.

A.4. Disclosure Frames and Equilibrium

By characterizing the equilibria, we demonstrate how the disclosure strategies are linked with management forecasts.

First, let $\Phi \equiv P(x^R) - P(x)$ denote the difference between the stock price following the announcement of earnings forecast and the stock price when the actual earnings are released. This sign of this trend indicates either positive or negative framing for managers' private information regarding future earnings. We define $u > m$ to be good news and $u < m$ to be bad news;

[16] Read more: http://www.businessdictionary.com/definition/performance-bonus.html #ixzz2D4Qa36tG

when the prospects are higher than expectation it is good news, and when it is lower than expectation it is bad news. At $t = 1$ only the manager knows whether firm's prospects are either good or bad news. Specifically, for good news under positive framing ($\Phi < 0$) the manager releases the good news bit by bit until the actual earnings realize (increase in earnings). On the other hand, under negative framing ($\Phi > 0$) the manager releases the good news in order to push up the stock price up front while expecting it to decline later. The motivation for positive framing and negative framing is given contrarily for bad news. That is, for bad news under negative framing ($\Phi > 0$) the manager releases the bad news bit by bit until the actual earnings realize (decrease in earnings). On the other hand, under positive framing ($\Phi < 0$) the manager releases the bad news in order to push down the stock price right immediately and expects it to increase later.

Next we substitute the pricing functions (from equation (A.1)) into $U(x(e,u),\ x^R)$, i.e.:

$$P(x^R) = E(x|x^R) \text{ and } P(x) = x,$$

so that $\Phi = E(x|x^R) - x$. We can then rewrite the manager's payoff as a function of e and Φ:

$$\begin{aligned} U(x(e,u),x^R) = &\quad \alpha\left(\frac{P(x)+P(x^R)}{2}\right) + (1-\alpha)(x - E(x|x^R)) - \beta\frac{(E(x|x^R)-x)^2}{2} - \frac{e^2}{2} \\ = &\quad \alpha x - \tfrac{\alpha}{2}(x - E(x|x^R)) + (1-\alpha)(x - E(x|x^R)) - \beta\frac{(E(x|x^R)-x)^2}{2} - \frac{e^2}{2} \\ = &\quad \alpha\lambda e^{\theta}u^{1-\theta} - \frac{e^2}{2} + \tfrac{\alpha}{2}\Phi - (1-\alpha)\Phi - \beta\frac{\Phi^2}{2} \equiv U(x(e,u),\ \Phi). \end{aligned} \tag{A.3}$$

From equation (A.3) we can identify the costs and benefits of increasing Φ and increasing e. These terms are useful when we give empirical interpretations for the manager's decisions on disclosure strategies. First, the benefit of increasing Φ is the increase in compensation from equity-based awards: $\frac{\alpha}{2}\Phi$, while the cost of increasing Φ is the loss in performance bonus: $-(1-\alpha)\Phi$ and the manipulation cost: $\beta\frac{\Phi^2}{2}$. Second, the benefit of increasing e is the increase in final earnings: $\alpha\lambda e^{\theta}u^{1-\theta}$, and the cost of increasing Φ is the effort cost: $\frac{e^2}{2}$.

Next we can rewrite the manager's maximization problem as:

$$\max_{\Phi,\ e} U(x(e,u),\Phi).$$

The first-order condition of maximization is:[17]

$$\frac{\partial}{\partial(\Phi,e)}\left\{\alpha\lambda e^{\theta}u^{1-\theta} - \frac{e^2}{2} + \Phi\left(\left(\frac{3\alpha}{2} - 1\right) - \frac{\beta}{2}\Phi\right)\right\} = 0. \tag{A.4}$$

The manager seeks for a pair of (Φ, e) to keep this equality satisfied.

Several related definitions should not be confused with our notation of Φ. First, our definition of Φ refers to the difference between the perceived earnings ($E(x|x^R)$) and the actual earnings (x). This is different from the "precision of announcement" which is defined as $x^R - x$. Second, the notions of *positive framing* and *negative framing* should not be confused with the two relevant terms "overshooting" and "undershooting" indicating the cases with $x^R - x > 0$ and $x^R - x < 0$ respectively.

We identify two groups of equilibria: the equilibria with full effort and other equilibria involving either shirking or overworking. "Full effort" refers to the case with $\frac{\partial}{\partial e}\left[\alpha\lambda e^{\theta}u^{1-\theta} - \frac{e^2}{2}\right] = 0$; while "shirking or overworking" refers to the cases with $\frac{\partial}{\partial e}\left[\alpha\lambda e^{\theta}u^{1-\theta} - \frac{e^2}{2}\right] \gtrless 0$. All of these cases are possible since the maximization condition only requires the sum of net benefits for increasing Φ and e be zero (equation (A.4)). When the net benefit of increasing e is greater than, equal to, or smaller than zero, then the net benefit of increasing Φ must be smaller than, equal to, or greater than zero respectively in order to keep the equality in equation (A.4) satisfied.

A.5. ***Full Effort Equilibrium***

In this equilibrium we have $\frac{\partial}{\partial e}\left[\alpha\lambda e^{\theta}u^{1-\theta} - \frac{e^2}{2}\right] = 0$. Let e^* denote this full effort. In order to satisfy equation (A.4) we need further $\frac{\partial}{\partial\Phi}\left[\Phi\left(\left(\frac{3\alpha}{2} - 1\right) - \frac{\beta}{2}\Phi\right)\right] = 0$. That is, $\left(\frac{3\alpha}{2} - 1\right) - \beta\Phi = 0$. Let Φ^* denote this disclosure strategy and:

$$\Phi^* = \frac{1}{\beta}\left(\frac{3\alpha}{2} - 1\right). \tag{A.5}$$

Therefore given the full effort the condition for a truth-telling equilibrium (i.e., $\Phi^* = 0$) is either $\beta = \infty$ or $\alpha = \frac{2}{3}$. $\beta = \infty$ indicates that there is a severe penalty for misreporting, and $\alpha = \frac{2}{3}$ requires that two-thirds of the managerial compensation be

[17] The second-order condition of maximization is satisfied.

equity-based awards. When $\alpha = \frac{2}{3}$ the benefit from the increase in equity-based award is offset by the implicit cost from the decrease in performance bonuses (i.e., $(\frac{3\alpha}{2} - 1) = 0$).

Proposition 1. *If $\beta = \infty$ or $\alpha = \frac{2}{3}$, then there exists a truth-telling equilibrium where x^R truly reveals the actual earnings x. However, if $\frac{1}{\beta}(\frac{3\alpha}{2} - 1) \neq 0$ then there will not be any separating equilibrium.*

When $\frac{1}{\beta}(\frac{3\alpha}{2} - 1) = 0$, the net benefit of increasing Φ is zero. When $\alpha > \frac{2}{3}$ the benefit from the increase in equity-based awards is higher than the decrease in performance bonus and manipulation cost so that $\Phi^* > 0$. When $\alpha < \frac{2}{3}$ the benefit from the increase in performance bonuses is higher than the implicit loss from the decrease in equity-based awards so that $\Phi^* < 0$. In other words, the choice of Φ^* depends on α. As αincreases, so does the probability that $\alpha > \frac{2}{3}$ will increase and the probability that $\Phi > 0$ will increase. The probability of choosing $\Phi > 0$ is therefore increasing in $\alpha$and the possibility of choosing $\Phi < 0$ is increasing in $1 - \alpha$ (or decreasing in α).

Based on the above argument we provide the following prediction.

Prediction 1. *The possibility of choosing $\Phi > 0$ is increasing in α; the possibility of choosing $\Phi < 0$ is decreasing in α.*

Our results predict that for either good news or bad news the probability of choosing negative disclosure framing increases in α while the probability of choosing negative disclosure framing increases in $1 - \alpha$ (or decreases in α). Intuitively, when the equity-based awards increase the *net* benefit from increasing Φ is more likely to become positive. The net benefit from increasing Φ is a sum of benefit from equity-based compensations, implicit loss in performance bonuses, and the explicit cost of price manipulation. The probability of choosing $\Phi > 0$ will accordingly increase with equity-based compensation. On the other hand, the probability of choosing $\Phi < 0$ will decrease with equity-based compensation.

Our results therefore predict that for either good news or bad news the probability of *positive framing* will decrease with the proportion of equity-based compensation, while the probability of *negative framing* will increase with the proportion of equity-based compensation. Alternatively, when the proportion of performance bonuses increases the probability of negative framing (positive framing) will decrease (increase).

A.6. ***Other Equilibria***

In addition to the full effort equilibrium we now characterize the properties for other equilibria involving either shirking or overworking (i.e., pooling equilibria). If the manager shirks (i.e., $\frac{\partial}{\partial e}\left(\alpha\lambda e^{\theta}u^{1-\theta} - \frac{e^2}{2}\right) > 0$) or overworks (i.e., $\frac{\partial}{\partial e}\left(\alpha\lambda e^{\theta}u^{1-\theta} - \frac{e^2}{2}\right) < 0$)[18] then we must have either $\frac{\partial}{\partial\Phi}\{\Phi((\frac{3\alpha}{2} - 1) - \frac{\beta}{2}\Phi)\} < 0$ or > 0 in order to satisfy the first-order condition in Eq. (A.4).

A.7. *Information Type and Choice of Φ and e*

Here we examine how the information type (good or bad news) affects the manager's choices on disclosure framing and effort. Recall that m is the mean of the distribution F for the firm's prospects. We define $u > m$ to be good news and $u < m$ to be bad news. When the prospects are higher than expectation it is good news; when it is lower than expectation, it is bad news. At $t = 1$ only the manager knows whether the firm's prospects are either good or bad news.

We explain how the choice of disclosure framing will affect the manager's effort decision under different information types.

First, for good news ($u > m$) since the term $\alpha\lambda e^{\theta}u^{1-\theta}$ will be greater than expected, the net benefit of increasing e is higher than expected. Ceteris paribus, the manager should increase effort in order to reduce this net benefit. Moreover, if positive framing ($\Phi < 0$) is adopted then the net benefit of Φ will be $(1 - \frac{3\alpha}{2}) - \frac{\beta}{2}\Phi$. Given that $\Phi < 0$, this net benefit will be negative if $\alpha > \frac{2}{3} - \frac{\beta}{3}\Phi$ and it will be positive if otherwise. For good news the overall net benefits of increasing Φ and e can be either higher or lower than expected depending on the relative size of α and Φ. If the overall net benefits are higher than expected then the manager must increase effort in order to reduce the overall net benefits keeping the first-order condition satisfied. However, if the overall net benefits are lower than expected the manager must decrease effort in order to pull up the overall net benefits keeping the first-order condition satisfied.

Second, for bad news ($u < m$) since the term $\alpha\lambda e^{\theta}u^{1-\theta}$ will be smaller than expected, the net benefit of increasing e is lower than expected. Ceteris paribus, the manager should decrease effort in order to reduce this net benefit. Moreover, if negative framing ($\Phi > 0$) is adopted then the net benefit of Φ will be $(\frac{3\alpha}{2} - 1) - \frac{\beta}{2}\Phi$. If $\alpha > \frac{2}{3} - \frac{\beta}{3}\Phi$ then this net benefit will be positive; otherwise it will be negative. For bad news the overall net benefits of increasing Φ and e can be either higher or lower than expected depending on the relative size of α and Φ. If the overall net benefits are higher than expected, then the manager must increase effort in order to reduce the overall net benefits keeping the first-order condition satisfied. However, if the overall net benefits are lower than expected then the manager must decrease effort in order to pull up the overall net benefits keeping the first-order condition satisfied.

[18] Since $\alpha x - \frac{e^2}{2}$ is concave in e, a smaller e will cause the partial derivative of e to be greater than zero.

Based on the above arguments, for good news positive disclosure framing may either increase or decrease managerial efforts; for bad news negative disclosure framing may either increase or decrease managerial effort. We provide the following prediction.

Prediction 2 *For good or bad news managers' effort levels can either increase or decrease with the probability of using positive framing.*

A.8. Managerial Overoptimism and Choice of Φ and e

Regarding the impacts of *managerial overoptimism* on the choice of disclosure strategies we predict that for good news the probability of using positive framing will increase with managerial overoptimism. In contrast, for bad news the impact of overoptimism on the choice of disclosure strategies is uncertain.

The effect of managerial overoptimism is similar to that of good news, i.e., the term $\alpha\lambda e^{\theta}u^{1-\theta}$ will be greater than $\alpha e^{\theta}u^{1-\theta}$ ($\lambda = 1$ for non-overoptimism). Given that $\alpha\lambda e^{\theta}u^{1-\theta}$ will be greater than expected for good news, when we calculate the net benefit of increasing Φ the implicit loss in performance bonus will be higher with managerial overoptimism. The net benefit of increasing Φ is therefore less with an overoptimistic manager. *Ceteris paribus, the manager should decrease Φ in order to pull up this net benefit (by concavity). For good news the probability of using positive framing ($\Phi < 0$) is therefore higher with managerial overoptimism.*

For bad news $\alpha\lambda e^{\theta}u^{1-\theta}$ will be lower than expected. However, managerial overoptimism will increase this term as $\alpha\lambda e^{\theta}u^{1-\theta}$ is greater than $\alpha e^{\theta}u^{1-\theta}$. The overall impact accordingly depends on the relative effects of bad news and managerial overoptimism. If the positive effect from overoptimism dominates then the implicit loss in performance bonus will be higher, so the net benefit of increasing Φ is less with an overoptimistic manager. Ceteris paribus, the manager should decrease Φ in order to pull up this net benefit (by concavity). The probability of using positive framing ($\Phi < 0$) is accordingly higher with managerial overoptimism. On the other hand, if bad news's negative effect dominates the implicit loss in performance bonus will be smaller. The net benefit of increasing Φ is therefore higher with an overoptimistic manager. Ceteris paribus, the manager should increase Φ in order to reduce this net benefit (by concavity). For bad news the impact of managerial overoptimism on the choice of positive framing ($\Phi < 0$) is accordingly lower with managerial overoptimism.

Based on the above arguments, for good news the incentive of using positive framing in disclosures increases with managerial overoptimism. However, for bad news managerial overoptimism may either incentivize or disincentivize using positive framing in disclosures. We provide the following prediction.

Prediction 3 *For good news, the probability of using positive framing will increase with managerial overoptimism; for bad news, the impact of managerial overoptimism on the choice of disclosure strategy is uncertain.*

Regarding the impacts of *managerial overoptimism* on the manager's effort decision we predict that for good news managers' effort levels will increase with managerial overoptimism, while for bad news managers' effort levels can either increase or decrease with managerial overoptimism.

For good news $\alpha\lambda e^{\theta}u^{1-\theta}$ will be greater than expected, and this term is even higher if the manager is overoptimistic. The net benefit of increasing *e* is greater with managerial overoptimism, and *ceteris paribus*, the manager should increase effort in order to lower this net benefit.

For bad news $\alpha\lambda e^{\theta}u^{1-\theta}$ will be lower than expected, but this term will be higher if the manager is overoptimistic. The overall impact accordingly depends on the relative effects of bad news and overoptimism. If the negative effect from bad news dominates then the overall benefit will decrease and managers must decrease the effort keeping the first-order condition satisfied. Alternatively, if the positive effect from managerial overoptimism dominates then the overall benefit will increase and managers must increase the effort keeping the first-order condition satisfied.

Based on the above arguments, for good news managerial overoptimism will incentivize an increase in managerial effort; for bad news managerial overoptimism may either incentivize or disincentivize managerial efforts. We provide the following prediction.

Prediction 4 *For good news, managerial overoptimism ($\lambda > 1$) will generate high managerial effort levels (e) ; for bad news, the impact of managerial overoptimism on managerial effort levels is ambiguous.*

The next prediction concerns stock return volatility and the choice of disclosure strategy. The consulting company McKinsey (Hsieh et al., 2006)[19] point out that:

> *Many executives believe that providing earnings guidance helps them to maintain an open channel of communication with investors in their companies and to increase the visibility of those companies while reducing the volatility of share prices and improving share valuations.*

[19] Notice that the McKinsey article, the CFA Institute white paper, and the U.S. Chamber of Commerce Commission all recommend that companies eliminate quarterly earnings guidance rather than annual guidance, arguing that quarterly earnings guidance induces short-termism (Hsieh et al., 2006; CFA Institute, 2006; U.S. Chamber of Commerce, 2007).

Further, the extant literature documents that investors will overreact to bad news (Veronesi, 1999). Jackson (2011) studies the stock return volatility surrounding management earnings forecasts and shows that management earnings forecasts containing bad news experience greater stock return volatility levels. Based on extant studies we accordingly expect that the downward disclosure strategy may cause greater stock return volatility while the upward disclosure strategy may lead to less stock return volatility. Stock volatility is either negatively related to the choice of positive framing for good news, or positively related to the choice of negative framing for bad news.

A.9. Comparing the Analytical Model to Guttman et al. (2006)

In this section we address the similarities and differences between Guttman et al. (2006) and our analytical model. First, our model is similar to Guttman et al. (2006) in the following two views. First, we also assume that investors are risk-neutral and accordingly price stock proportional to the expected value conditional on all available information; we have also quoted the reference provided by Guttman et al. (2006) justifying this assumption. Second, we also consider the signaling role of management earning forecasts.

Second, the main characteristics of Guttman et al. (2006) model are given below. In Guttman et al. (2006): (*i*) the manager is privately informed of the actual earnings (i.e., x) and the manager's strategy is to choose a report (x^R) according to x; (*ii*) there are two types of equilibria designated as separating and partial pooling. In the *separating equilibrium* the report is a linear function of the actual earnings, and therefore one can fully infer the actual earnings. This result is testable since the dispersion $(x^R - x)$ will be related to equity-related compensation as well as earnings manipulation costs. In Table 7 we have provided a regression result for this relationship. Furthermore, in the *partial pooling equilibrium* the manager will report the true earnings if the actual earnings are either sufficiently low or sufficiently high. He or she will pool the intermediate levels of actual earnings. Similar to the arguments by Crawford and Sobel (1982), this type of equilibrium is supported by the implicit signaling cost caused by the convex manipulation cost function.This assumption is common in the literature such as Fischer and Verrecchia (2000); Sankar and Subramanyam (2001); and Verrecchia (2001).

Based on the characteristics of Guttman et al. (2006) as mentioned above, our analytical model is different in the following two views. First, the manager is privately informed of the firm's prospects (μ). The actual earnings are determined by both the firm's prospects and managerial effort (i.e., $x(e,u) = \lambda e^{\theta} u^{1-\theta}$). The earnings forecast is a report (x^R) about x, not about μ. Notice that since x is a function of μ, whether or not the reported x^R can truly infer private information regarding μ will depend on the choice of effort level. The manager's strategy is to choose a disclosure framing (i.e., $\Phi \equiv P(x^R) - P(x)$, positive or negative framing in disclosures), not about the difference $(x^R - x)$. The choice of disclosure framing will signal both private information concerning the firm's prospects and the manager's effort decision, which is absent in Guttman et al. (2006). Second, we calculate the first-order condition of maximization with respect to both the disclosure framing and effort level. According to this condition we can indeed conclude a one-to-one relationship between the disclosure pattern and μ under full effort. In this sense our equilibrium is a separating equilibrium, although the manager's strategy is not x^R and the private information is not about x. In addition to the case with full effort we have also considered other combinations of (disclosure framing or effort) involving either shirking or overworking (keeping the first-order condition satisfied). Since the actual earnings are related to the manager's degree of overoptimism and the type of news (good or bad), while the manager's benefits are related to both equity and non-equity compensations and manipulation costs, we can conclude several testable results concerning the relationship between disclosure framing, effort, and these variables. We have not yet addressed the issues regarding partial pooling, but instead we focus on disclosure framing choices and effort decisions.

Appendix B. Measurement of Variables

In Appendix B, we give detailed definitions for firm performance (stock return volatility) and misreporting.

B.1. Management Forecasts

For the remaining 2,309 observations, management forecasts are defined as the average of the Company Issued Guidelines. That is, the management forecast, Averageeps, is defined as Averageeps=$(EST\_1 + EST\_2)/2$). EST_1 and EST_2 are the forecasted lower and upper bounds given by the dataset I/B/E/S. If either EST_1 or EST_2 is missing, then management forecasts are defined as the remaining estimates. For example, if $EST\_1 = 1.32$ and EST_2=1.48, then the management forecast is 1.4=(1.32 + 1.48)/2. However, if EST_1=1.25 and EST_2=NA, then the management forecast is 1.25.

B.2. Firm Performance and Misreporting

We use *Stock_Volatility* in order to measure firm performance. *Stock_Volatility* is defined as the standard deviation of daily stock returns over the fiscal year, expressed in percentage terms. Finally, *Misreporting* denotes the misreporting levels measured by the absolute value of the difference between the management forecasts and the reporting of actual EPS.

Appendix C. Descriptive Statistics and Correlation Matrix

C.1. Definitions of Variables

Salary: Salary/Total Compensation.
Bonus: Bonus/Total Compensation.
Stock_Awards: Value of Stock Awards/Total Compensation.
Option_Awards: Value of Options Awards/Total Compensation.
Noneq_Incent: Non-Equity Incentive Plan Compensation/Total Compensation.
Pension_Chg: Change in Pension Value and NonQualified Deferred Compensation/Total Compensation.
Othcomp: All Other Compensation/Total Compensation.
Size: Natural logarithm of book value of assets.
Sales: Firm sales in millions.
Ppeemp: Net property, plant, and equipment per employee.
Leverage: Long-term debt plus debt in current liabilities over long-term debt plus debt in. current liabilities plus the book value of common equity
Cashholding: Cash and short-term investments over net property, plant, and equipment at. the beginning of the fiscal year
Stock_Volatility: The standard deviation of daily stock returns over the fiscal year.
Misreporting: The absolute value of the difference between the management forecasts and reporting of actual EPS.
Weak: Indicator variable that is equal to one if the firm disclosed a material. weakness during our sample period, and 0 otherwise

C.2. Descriptive Statistics

Table C.1 presents the descriptive statistics of the variables used in this study.

C.3. Correlation Matrix

Table C.2 presents the correlation matrix of the explanatory variables and controlled variables for the full sample. As shown, the highest correlation coefficient between $Ln(Sale)$ and *Size* is 0.94, while the lowest is 0.00. The remaining correlation coefficients are approximately −0.50 to 0.55, all of which are acceptable when it comes to avoiding the problem of multi-collinearity. We solve the potential multi-collinearity problem between $Ln(Sale)$ and *Size* when both $Ln(Sale)$ and *Size* are included in the regression models by estimating the model using an instrument for *Sales* which is the residual ε_{Sale} from regressing $Ln(Sales) = \alpha + \beta Size$. Moreover, from the correlation tables the correlations between *Overoptimism* and *Option_Awards* is 0.10 and *Overoptimism* and *Stock_Awards* is −0.14, all of which are acceptable when it comes to avoiding the multicollinearity problem between these variables. There accordingly exists no multicollinearity problem between

Table C.1
Descriptive Statistics.

Variables	Obs.	Mean	Median	Std. Dev.	Min	Max
Positive_Framing	736	0.69	1.00	0.46	0.00	1.00
Negative_Framing	332	0.31	0.00	0.46	0.00	1.00
Overoptimism	1,068	0.61	1.00	0.49	0.00	1.00
Equity − Based_Comp	1,068	0.19	0.15	0.14	0.00	1.00
Non-Equity-Based_Comp	1,068	0.02	0.00	0.06	0.00	0.59
Noneq_Incent	1,068	0.19	0.18	0.14	0.00	0.76
Pension_Chg	1,068	0.07	0.00	0.22	−0.01	5.14
Othcomp	1,068	0.03	0.01	0.06	−0.13	1.00
Size	1,068	8.19	8.24	1.70	2.34	12.23
Logarithm of Sale	1,068	8.02	8.08	1.74	3.07	13.09
Sales Growth$(t\text{-}1)$	1,068	8.20	6.61	15.67	−70.95	125.03
Ppeemp	1,068	0.06	0.04	0.07	0.00	0.48
Leverage	1,068	0.33	0.32	0.27	−1.16	2.61
Cashholding	1,068	1.36	0.35	3.81	0.00	63.99
Growth of Sales	1,068	7.86	6.39	15.23	−59.98	125.03
Stock_Volatility	1,068	0.02	0.02	0.01	0.01	0.11
Misreporting	1,068	1.48	0.15	39.70	0.00	1,297.6
Weak	758	0.02	0.00	0.14	0.00	1.00

Notes: The table gives the statistics of variables used in this study. The sample consists of company-issued guidance data for all nonfinancial anf nonutility firms from Thomson Reuters' Instituional Brokers' Estimate System (I/B/E/S) fro the period from 2009 to 2017, since during the period of global recession the revealed information is supposed to have been valuated most carefully. In order to be included in the sample, firms are required to have executive compensation details from Execucomp, accounting data from Compustat, stock returns data from CRSP, and internal control data from Audit Analytics. Variable definitions are provided in Appendix C.

Table C.2
Correlation Matrix.

	Overoptimism	*Salary*	*Bonus*	*Stock_Awards*	*Option_Awards*	*Noneq_Incent*	*Pension*	*Othercomp*	*Size*	*Logarithm of Sale*	*Growth of Sales*	*Ppeemp*	*Leverage*	*Cashholding*
Overoptimism	1													
Salary	−0.10	1												
Bonus	−0.06	0.11	1											
Stock_Awards	−0.14	−0.26	−0.06	1										
Option_Awards	0.10	0.02	−0.02	−0.31	1									
Noneq_Incent	0.10	−0.05	−0.26	−0.34	−0.01	1								
Pension	−0.06	−0.08	−0.02	−0.05	−0.03	0.04	1							
Othcomp	0.00	0.00	−0.04	−0.15	−0.06	−0.07	0.55	1						
Size	−0.10	−0.50	−0.06	0.15	−0.04	0.13	0.16	0.05	1					
Logarithm of Sale	−0.11	−0.44	−0.09	0.10	−0.04	0.15	0.18	0.06	0.94	1				
Growth of Sales	0.19	−0.04	0.00	−0.01	0.03	0.06	−0.10	−0.07	−0.14	−0.26	1			
Ppeemp	−0.10	−0.16	−0.07	0.09	−0.03	0.08	0.02	−0.03	0.40	0.28	−0.03	1		
Leverage	−0.12	−0.21	−0.03	0.00	−0.03	0.09	0.06	0.03	0.41	0.41	−0.14	0.24	1	
Cashlolding	0.10	−0.03	0.05	0.05	0.04	−0.11	−0.08	−0.07	−0.21	−0.33	0.20	−0.09	−0.08	1

Overoptimism and *Option_Awards* and between *Overoptimism* and *Stock_Awards* when these variables are included in the regression models.

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