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The Role of Executive Risk-Taking Incentives in Voluntary Disclosure Accuracy

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ABSTRACT: We investigate whether common compensation features encourage managers to reveal their private information. Assuming managers have private knowledge of future earnings, we use management forecast accuracy to proxy for the extent to which managers reveal private information and offer two main findings. First, both the amount of a manager's severance pay and the convexity of their stock option portfolio (i.e., vega) are positively associated with forecast accuracy. This suggests managers are more forthcoming if compensated in ways that reduce concerns over firm volatility. Second, these incentives are more strongly associated with forecast accuracy when short-term pressure to conceal private information is higher. Additional analyses suggest these results are unlikely explained by earnings management subsequent to the forecast, managers with these incentives issue less optimistically biased forecasts, and these contracts increase forecast accuracy of good and bad news. Overall, our results suggest compensation can encourage managers to provide more accurate disclosures.

Keywords: management forecast accuracy; compensation incentives; truthful disclosure; voluntary disclosure.

I. INTRODUCTION

Managers possess private information about their firm's prospects and choose whether to voluntarily provide all (or some portion) of that information to investors. Theory argues that managers do not voluntarily provide their private information due to a number of frictions, and that some of these frictions relate to the undiversified and risk-averse nature of executives (Bamber, Jiang, and Wang 2010; Beyer, Cohen, Lys, and Walther 2010; Nagar, Nanda, and Wysocki 2003). Prior research provides evidence suggesting that compensation contracts with convex payoffs encourage risk-averse managers to accept risky investment projects that maximize firm value (e.g., Coles, Daniel, and Naveen 2006; Cadman, Campbell, and Klasa 2016). In this study, we examine whether these same contracts encourage managers to disclose their private information in a more truthful and unbiased way.

Disclosure plays two primary roles in capital markets (Beyer et al. 2010). First, disclosure plays an *ex ante* or valuation role by helping investors decide how to allocate capital across firms. Second, disclosure plays an *ex post* or stewardship role by

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helping investors monitor managers' performance after they invest by helping them understand what portion of firm performance is due to managerial skill as opposed to luck. Agency problems might encourage managers to hold back a portion of their private information so the manager could attribute any good outcome to skill rather than luck, and blame any bad outcome on luck as opposed to skill (Beyer et al. 2010). As a result, shareholders should prefer managers to provide disclosures free from agency problems, resulting in more truthful, accurate, and unbiased disclosures.

We examine whether compensation contracts can encourage managers to reveal more of their private information in a truthful and accurate way. To test this question, we require measures of (1) compensation contracts and (2) managers' voluntary revelation of private information. For compensation contracts, we focus on two measures: *ex ante* severance pay and stock option convexity (i.e., vega). The literature distinguishes between two types of managerial risk aversion: (1) aversion to downside risk (i.e., left-tail risk) and (2) aversion to overall risk (i.e., earnings and stock price volatility). These two components of compensation reduce each type of risk aversion and thus encourage more forthcoming and unbiased disclosure. Severance pay protects managers from downside (or left-tail) risk by compensating them in the event that bad news disclosure leads to reputational and career damage. Vega increases option value when stock prices are more volatile, and thus compensates the manager in the event that more truthful disclosure leads to incremental volatility in general.

For our measure of managers' revelation of private information, we focus on the accuracy of managers' most salient voluntary disclosure, management earnings forecasts (Beyer et al. 2010). If managers disclose information free from agency problems, then holding constant all other frictions to disclose, their forecasts should be more accurate. In other words, under the assumption managers have private knowledge of their firms' future earnings, management forecast accuracy should increase as managers are more forthcoming, as any withholding of information reduces accuracy.

It is possible that severance pay and vega do not lead to more accurate management forecasts. Specifically, additional operational risk-taking attributable to severance pay or vega may make earnings harder to predict, resulting in less accurate forecasts. Furthermore, high vega managers less concerned with stock price volatility might also be less concerned with managing earnings to meet their previously issued forecast.

We define management forecast accuracy as the absolute difference between the management forecast and actual earnings for the same time-period, scaled such that higher values indicate more accurate forecasts. Using a within-firm design (i.e., firm fixed effects), we regress management forecast accuracy on the amount of CEO severance pay and the risk-taking incentives provided by the CEO's stock option portfolio (i.e., vega of stock options), controlling for known manager-level, firm-level, and industry-level determinants of management earnings forecast accuracy, severance pay, and vega. Consistent with our predictions, we find positive associations between forecast accuracy and both severance pay and vega.

We expect our hypothesized main effects to be stronger when short-term pressure on the manager is higher, and thus when the benefits of encouraging truthful disclosure are greater. This pressure should be greater when (1) transient institutional ownership is higher, as transient institutions have short trading horizons and care more about short-term profits than long-term value (e.g., Ramalingegowda 2014), and (2) shareholders are more likely to evaluate the manager based on his/her current performance (i.e., the manager faces higher career concerns). Consistent with expectations, we find that the effect of severance and option pay incentives on forecast accuracy is stronger when managers face greater short-term performance pressure, suggesting that the long-term incentives provided by severance and stock option compensation are more salient when managers' short-term focus might otherwise encourage them to withhold more of their private information.

An alternative explanation for our findings is that managers with severance and stock option convexity appear to be "more accurate" because they engage in higher levels of earnings management to meet their forecasts. Although prior research documents a *negative* association between severance pay and earnings management (Brown 2015), Armstrong, Larcker, Ormazabal, and Taylor (2013) find a *positive* relation between vega and financial misreporting, suggesting this alternative explanation is plausible for vega. We address this issue in several ways. First, we replicate the Armstrong et al. (2013) result showing a positive relation between vega and absolute discretionary accruals, but we also do not observe that such relation exists in our sample, consistent with prior literature which suggests firms that forecast engage in less earnings management. In the same vein, we also fail to find evidence of an association between absolute accruals and vega in our sample. Second, following Hutton, Lee, and Shu (2012) we replicate our primary results after excluding firms that are more likely to have engaged in earnings management to meet their forecast. Finally, we replicate our primary results using managers' *sales* forecast accuracy as the dependent variable because prior research suggests revenues are less vulnerable to manipulation by management (Ertimur, Livnat, and Martikainen 2003; Koo and Lee 2018).

While no archival study can definitively establish causality, we attempt to mitigate concerns that our tests reflect associations due to reverse causality or correlated omitted variables through a number of additional tests. First, our primary results generally hold using a changes analysis. Second, we obtain similar inferences if we lag our compensation variables (which are already measured as of the beginning of the fiscal year) by one year to ensure the compensation features have time to influence management forecast decisions. Third, as a falsification test, we *lead* our compensation variables by one year and find no association between current year forecast accuracy and *next year* compensation. Fourth, we obtain similar inferences after

performing matching procedures on either severance pay or vega using entropy balancing (e.g., McMullin and Schonberger 2020). Fifth, we conduct three tests to address a specific potential correlated omitted variable—manager ability. Our results hold after (1) controlling for managerial ability, (2) controlling for all known determinants of severance and option contracts, and (3) replacing firm fixed effects with manager fixed effects. Despite our best efforts to address causality, as in all archival studies (and in particular compensation studies) we cannot definitively conclude that our results reflect a causal relation. However, at a minimum, our results are consistent with severance pay and stock option convexity being forms of efficient contracting in that they are associated with CEOs providing more accurate forecasts and, thus, revealing more of their private information.

In additional analysis, we examine whether our results differ when managers' private information is positive or negative. If severance pay and vega reduce managers' concerns over downside risk, these contracts should not only increase forecast accuracy but also reduce managers' disclosure *optimism*. Consistent with this expectation, we find that both severance pay and vega are negatively associated with management forecast *bias*. To further consider this point, we partition our sample into good news forecasts (i.e., when the forecast reveals positive information to the market) and bad news earnings forecasts (i.e., when the forecast reveals negative information to the market). The bad news forecast sample should speak to managers' willingness to reveal their private information about bad news (i.e., downside risk), while the good news sample should speak to managers' willingness to reveal their private information about overall risk (i.e., volatility). Our results hold in both subsamples. Taken together, our results suggest severance pay and vega reduce managers' concerns over *both* (1) downside (left-tail) risk and (2) overall (volatility) risk.

Finally, as alternative proxies to management forecast accuracy, we examine whether *analysts'* forecast outputs are higher quality following management forecasts from managers with higher severance pay and vega. We find that (1) accuracy of consensus analyst forecasts is greater, and (2) to a lesser extent, analyst forecast dispersion is smaller following management forecasts from managers with greater severance pay and vega.

We contribute to the literature examining the extent to which managers reveal their private information. While prior work documents that firms can commit to *ex ante* revelations of private information by listing as a public versus a private firm (Burgstahler, Hail, and Leuz 2006; Leuz, Triantis, and Wang 2008) or by listing in a particular jurisdiction (Coffee 1999; Ball, Kothari, and Robin 2000; Rock 2001), there is surprisingly little research examining the mechanisms to encourage managers to reveal their private information *within a given reporting regime*. A notable exception is Ball, Jayaraman, and Shivakumar (2012), who provide evidence that higher excess audit fees also lead to higher-quality voluntary disclosure. That is, auditors can encourage managers to voluntarily reveal more of their private information. We contribute to this literature by identifying compensation mechanisms, severance pay and stock option vega, that enhance voluntary disclosure quality.[1]

We also contribute to the management forecast literature. Our findings that severance pay and stock option vega correspond to greater management forecast accuracy stand in contrast to prior studies showing that the timing and content of forecasts depend on the extent to which managers' stock holdings are influenced by the *current stock price* (i.e., delta). In these studies, option delta *decreases* the usefulness of management forecasts (e.g., Noe 1999; Aboody and Kasznik 2000; Cheng and Lo 2006).[2] Although most prior work focuses on the implications of option delta on management forecast activity, a contemporaneous paper by Cho, Tsui, and Yang (2021) argues that management forecasting is risky because it magnifies investor reaction to earnings surprises (both good and bad), and that vega can encourage managers to issue forecasts. Consistent with this prediction, they document that managers with higher vega are more likely to issue forecasts. In contrast, our paper examines—conditional on the manager deciding to issue a forecast—whether vega encourages managers to provide more accurate forecasts. We view our studies as complementary, as together they suggest that when managers have greater option vega, they not only issue more forecasts but those forecasts are more accurate. Finally, we are the first study to examine the implications of manager severance pay on forecast quality.

Finally, we contribute to the broader question of whether compensation incentives are a result of efficient contracting between shareholders and managers (e.g., Lambert and Larcker 1985, 1987; Smith and Watts 1992) or are instead a manifestation of agency problems where powerful managers extract rents from their shareholders (e.g., Bebchuk and Fried 2003, 2004). Consistent with efficient contracting, prior studies find that severance pay (Cadman et al. 2016) and stock options (Core and Guay 2001) encourage otherwise risk-averse managers to take reasonable and value-increasing levels of operational

[1] In a related study, Baginski, Campbell, Hinson, and Koo (2018) document that managers with high *ex ante* severance pay have less *delay* in disclosing bad news relative to good news. In contrast, we examine how severance pay influences the accuracy of revealed private information, regardless of the tenor of the news. In addition, we re-perform our main analyses on a subset of *good news* management forecasts and show that our results for severance pay hold (see Section VI). Thus, the effect of *ex ante* severance pay on managers' willingness to reveal their private information is not just limited to bad news disclosures.

[2] We do not claim that compensation plans eliminate opportunistic behavior in management forecasting. For example, Aboody and Kasznik's (2000) conclusion that managers opportunistically *time* their management forecasts to maximize the value of stock option awards is not inconsistent with our findings.

risk. Our results suggest these incentives also result in managers providing more truthful reporting, further supporting the notion that these compensation contracts represent efficient contracting between shareholders and managers.[3]

II. HYPOTHESES

Compensation Contracts and Voluntary Management Earnings Forecasts

Managers are naturally risk-averse with respect to two types of risk: (1) downside risk (i.e., left-tail risk) and (2) overall risk (i.e., earnings and stock return volatility risk). Because managers face career concerns and are naturally risk-averse (i.e., have concave utility functions) while shareholders prefer agents that are risk-neutral, compensation committees design compensation packages to encourage otherwise risk-averse managers to take on reasonable levels of risk. One element of compensation by which to relieve managers' career concerns and encourage reasonable levels of risk-taking is through *ex ante* severance pay. Severance pay compensates the manager in the event that s/he is involuntarily terminated. Consistent with this idea, prior research provides evidence that severance pay reduces career concerns and induces managers to take reasonable levels of *operational* risk (e.g., Cadman et al. 2016).

Stock compensation convexity represents another element of compensation that encourages managers to take risk. Option compensation convexity, or vega, refers to the fact that the value of a stock option increases when stock price *volatility* is higher, as higher stock price volatility leads to a greater possibility that the stock price exceeds the exercise price (and by a greater margin). Research generally suggests CEOs take greater levels of *operational* risk when compensation packages exhibit higher vega (e.g., Coles et al. 2006; Chava and Purnanandam 2010), though this link has been challenged (e.g., Hayes, Lemmon, and Qiu 2012; Billings, Moon, Morton, and Wallace 2020).

While these prior studies examine the effect of compensation on *operational* risk-taking, we focus on the effects of compensation on *disclosure* risk-taking. In other words, while prior papers study the impact of compensation on "managing the firm," we have less evidence on how these compensation contracts will impact managers "managing the flow of information between managers and investors." We predict that severance pay and stock option vega will lead to disclosure that is more truthful and accurate.

Holding constant operational decisions, risk-averse managers are also unlikely willing to engage in risky *disclosure* decisions if those disclosures subject them to greater downside and overall risk. For example, Nagar et al. (2003) point out that managers are reluctant to disclose because disclosure can cause the labor market to reassess managerial ability and because less disclosure makes it more difficult for investors to discipline managers, resulting in entrenchment. Further, with respect to good news, if managers expect good news prior to the mandated earnings report, they are unwilling to disclose it early through a voluntary forecast because doing so can increase the risk of litigation and loss of reputation if the good news is not subsequently realized (King, Pownall, and Waymire 1990). With respect to bad news, if they expect bad news prior to the earnings report, they are unwilling to disclose it because of the risk to their careers of an immediate large negative stock price reaction (e.g., Kothari, Shu, and Wysocki 2009). They also risk a downward evaluation of their quality because the bad news early disclosure creates the perception that they lack the ability to take actions to mitigate the bad news between the date of disclosure and subsequent mandated public revelation of the news.

Truthful and accurate disclosure can be distinguished from "full disclosure" referenced in theoretical work. Theoretical work discusses the six conditions needed for full disclosure to occur, or in other words, the six conditions required for managers to voluntarily provide all of their private information (e.g., Grossman and Hart 1980; Grossman 1981; Milgrom 1981): (1) disclosure is costless; (2) investors are aware managers have private information; (3) all investors interpret disclosures efficiently and identically; (4) managers' objective function is to maximize firm value; (5) firms can credibly disclose private information; (6) firms cannot *ex ante* commit to a specific disclosure policy. Severance pay and stock option vega primarily relate to assumption #4, which is related to agency problems between shareholders and managers. Thus, while severance pay and vega should lead to more truthful and accurate disclosures, it will not lead managers with higher severance and vega to *fully* reveal their private information, given the five other frictions that are still present, which refer to things such as proprietary costs, varying levels of investor sophistication, etc. (Beyer et al. 2010).

[3] Prior studies examining the effect of compensation on operational risk-taking focus on managers "managing the firm," while our study on the effect of compensation on reporting decisions focuses on managers "managing the flow of information between managers and investors." In other words, although we can assume from prior literature that compensation incentives encourage the manager to take a risky investment project, we do not know how forthcoming the manager will be with investors about having taken that project and how risky it is. Our study differs from prior studies on operational risk-taking because, conditional on taking greater operational risk, it is not clear whether and when a manager would be willing to submit to greater monitoring through more forthcoming disclosure.

We assume that the subsequently revealed actual earnings serves as a proxy for management's private information about current earnings at the date of the management forecast. Ciconte, Kirk, and Tucker (2014) find that, in more recent periods, actual earnings are very close to the upper bound of the previously issued management range forecast, lending validity to our forecast accuracy proxy (which we measure the same way as Ciconte et al. [2014] do). Therefore, management forecast accuracy serves as a proxy for the release of management's private information. Accordingly, we expect that managers with severance pay and relatively high option convexity (i.e., a higher vega) provide earnings forecasts that more accurately reflect the actual earnings outcome (i.e., are more accurate):

H1a: Severance pay is positively associated with the extent to which a manager's earnings forecast converges with the actual earnings outcome (i.e., the forecast's accuracy).

H1b: The convexity of stock option compensation (i.e., vega) is positively associated with the extent to which a manager's earnings forecast converges with the actual earnings outcome (i.e., the forecast's accuracy).

It should be noted that some theoretical work regarding the effect of stock options on disclosure behavior predicts that managers with more stock options will be *less* forthcoming (e.g., Goldman and Slezak 2006; Benmelech, Kandel, and Veronesi 2010). However, these papers examine the effect of the change in stock compensation value due to a change in the *current stock price* (i.e., the "delta" of the stock compensation). As such, we explicitly control for the effect of option delta.

Finally, as it relates to empirical evidence on the relation between stock option vega and other measures of financial reporting quality, the literature is somewhat mixed. For example, Blackburne and Quinn (2019) find stock option vega encourages more timely disclosure of the existence of an SEC investigation. However, Armstrong et al. (2013) present findings suggesting vega is *positively* associated with financial misreporting (e.g., restatements, enforcement actions, etc.), and Kim, H. Li, and S. Li (2015) link CEO vega to audit fees. Both studies suggest misreporting increases firm risk, so managers with higher vega have incentives to increase firm risk through misreporting. However, it is unclear how misreporting increases the *firm's* risk (unless the firm is eventually exposed for misreporting, and even then, the negative consequences of the misreporting would mostly fall on the *manager* who committed the misreporting). Furthermore, although the revelation of misreporting will cause price volatility, the price movement will be considerably downward, adversely impacting the manager's compensation (i.e., a delta effect).

The Effect of Short-Term Pressure

As discussed, the purpose of severance and stock option contracts is to align the interests of the manager with shareholders so that the manager makes decisions that result in increases to long-term firm value. This type of decision-making will be more difficult to make when managers feel greater short-term performance pressure. Managers likely feel greater short-term performance pressure when (1) transient institutional ownership is greater, because transient institutions have short trading horizons and trade for short-term profits (e.g., Ramalingegowda 2014) and/or (2) when the manager has greater career concerns and thus is less certain how disclosure may cause the labor market to reassess their ability (Nagar et al. 2003). We expect incentives related to disclosure to be more salient (and thus more beneficial) when short-term pressure is higher. Therefore, we expect that any associations between severance/stock option compensation and forecast accuracy are stronger when short-term performance pressure is relatively high. This leads to our second set of hypotheses:

H2a: The positive association between management forecast accuracy and severance pay is stronger when managers face more short-term performance pressure.

H2b: The positive association between management forecast accuracy and stock option convexity is stronger when managers face more short-term performance pressure.

We base these hypotheses on the assumption that the compensation contract incentives become more salient when managers feel greater performance pressure. Potentially offsetting our hypothesized effects is the possibility that high short-term performance pressure dominates any incentives provided by severance and option compensation.

III. RESEARCH DESIGN AND SAMPLE INFORMATION

Research Design

To test our first set of hypotheses, we follow prior research and measure the accuracy of managers' earnings forecasts (*MEF_Accuracy*) as the absolute difference between managers' earnings estimate and actual earnings, as reported by I/B/E/S Guidance, scaled by the beginning of fiscal period price and multiplied by −100 (such that higher values correspond to more

accurate forecasts). *MEF_Accuracy* is only defined for quantitative, closed-range or point forecasts.[4] For range forecasts, we treat the upper-bound as a point estimate based on evidence in Ciconte et al. (2014).[5] We then estimate the following model:

$$\begin{aligned} MEF\_Accuracy_{i,t} = {} & \alpha_0 + \alpha_1 \boldsymbol{SeverancePay_{i,t}} + \alpha_2 \boldsymbol{Vega_{i,t}} + \alpha_3 Delta_{i,t} + \alpha_4 InstitutionOwn_{i,t} + \alpha_5 Size_{i,t} + \alpha_6 AFollow_{i,t} \\ & + \alpha_7 MB_{i,t} + \alpha_8 IndustryConc_{i,t} + \alpha_9 LitRisk_{i,t} + \alpha_{10} Tenure_{i,t} + \alpha_{11} AccrQuality_{i,t} + \alpha_{12} Qtr_{i,t} \\ & + \alpha_{13} Horizon_{i,t} + \alpha_{14} Volatility_{i,t} + e_{i,t} \end{aligned} \tag{1}$$

where $MEF\_Accuracy_{i,t}$ is the accuracy of firm *i*'s forecast for period *t*. *SeverancePay* equals managers' *ex ante* contractually guaranteed severance pay, and *Vega* (*Delta*) equals managers' pay sensitivity to a 1 percent change in stock volatility (price). We scale these three variables by total cash compensation, similar to prior research (Baginski et al. 2018). We obtain severance pay data from Execucomp, which captures the dollar amounts a CEO would receive if s/he is involuntarily dismissed from employment or resigns for "good reason" (i.e., substantial demotion from duties and/or compensation; see Cadman et al. 2016). We calculate vega and delta of a manager's stock options and stock holdings using stock options and holdings data from Execucomp using formulae described in Appendix A. Recall that H1a (H1b) relates to severance pay (vega) and predicts a positive estimate for α_1 (α_2). Because we use delta as a control variable, we do not make a formal hypothesis about delta's association with *MEF_Accuracy,* but expect a negative estimate for α_3.

The remaining variables are based on prior research and attempt to control for factors affecting both our compensation variables and forecast accuracy (e.g., Yang 2012; Ajinkya, Bhojraj, and Sengupta 2005; Karamanou and Vafeas 2005). Specifically, we include basic firm characteristics such as firm size (*Size*) and market-to-book ratio *(MB*), which prior research link to more accurate earnings forecasts, as well as earnings volatility (*Volatility*), which research suggests relates negatively to accuracy. We also control for firms' litigation risk (*LitRisk*) but make no prediction, consistent with Yang (2012), and firms' industry concentration (*IndustryConc*), which likely correlates with firms' proprietary costs of disclosure (Verrecchia 1983; Yang 2012). We make no directional prediction on *IndustryConc,* given mixed results on the relation between disclosure and proprietary costs (e.g., Berger 2011; Kim, Taylor, and Verrecchia 2020).[6] Next, we consider properties of firms' information environment. Specifically, we expect institutional ownership (*InstitutionOwn*) to relate positively to accuracy. We also include analyst following (*AFollow*). Yang (2012) predicts a positive association between analyst following and accuracy yet observes a negative association. Therefore, we make no prediction. We control for forecast horizon (*Horizon*), expecting that longer horizon forecasts are inherently harder to forecast. Similarly, since we include both quarterly and annual EPS forecasts, like Yang (2012), we include an indicator, *Qtr*, to control for systematic differences in these two forecast types. Finally, we control for CEO tenure (*Tenure*) because executives' ability to forecast accurately likely increases with experience (Feng, Li, and McVay 2009; Ittner and Michels 2017) and a control for accruals quality (Dechow and Dichev 2002).

We intentionally exclude variables related to performance (e.g., return-on-assets) and investment decisions (e.g., acquisitions, research and development) because they are not pre-determined with respect to and are likely outcomes of *Vega* and *SeverancePay* (Whited, Swanquist, Shipman, and Moon 2021). All models include year fixed effects to control for general changes in the macro-economy over our sample period and firm fixed effects to eliminate across-firm variation in the dependent variables. Thus, our variables of interest (and controls) are confined to explaining variation in forecast accuracy for a given firm over time.

H2a and H2b predict that the effects of H1a and H1b are stronger when managers face more short-term performance pressure. To test this, we partition our sample using two measures that proxy for performance pressure: (1) transient institutional ownership and (2) managerial career concerns. For the latter, we follow Baginski et al. (2018) and utilize seven career concern proxies to employ a Principle Component Analysis (PCA) that identifies managers who face higher career concerns.[7] We then estimate Equation (1) as a fully interacted model, where we interact all independent variables (except firm fixed effects) with our proxy for short-term performance pressure. We expect the association between *MEF_Accuracy* and both *SeverancePay* and *Vega* is stronger in the high-transient institutional ownership and high career concerns partitions (i.e., positive interactions between the capital-market pressure proxies and *SeverancePay* and *Vega*).

[4] Detailed variable definitions, including data sources, are reported in Appendix A.

[5] If we instead use the midpoint, our inferences are unchanged.

[6] Our inferences are unchanged if we instead (1) control for proprietary costs using research and development or (2) include both research and development and industry concentration in the model.

[7] The seven proxies for career concerns are (1) *Young CEO:* an indicator variable equal to 1 if the manager is in the lower quartile of age, and 0 otherwise; (2) *Retiring CEO:* an indicator variable equal to 1 if the CEO is 63 years old or older, and 0 otherwise; (3) *New CEO:* an indicator variable equal to 1 if the CEO has been appointed within the past year, and 0 otherwise; (4) *High Volatility:* an indicator variable equal to 1 if the firm's market-adjusted volatility is in the upper quartile of the sample, and 0 otherwise*;* (5) *CEO Duality:* an indicator variable equal to 1 if the CEO is not also the chairman of the board, and 0 otherwise; (6) *Outside CEO:* an indicator variable equal to 1 if the CEO was hired from outside the firm, and 0 otherwise; and (7) *Pay-for-performance sensitivity:* an indicator variable equal to 1 if the CEO's pay for performance sensitivity (as measured in Jensen and Murphy 1990) is in the upper quartile of the sample, and 0 otherwise.

Sample Information and Descriptive Statistics

Our sample begins with quarterly and annual management forecasts of EPS available in the I/B/E/S Guidance Detail file. As reported in Panel A of Table 1, we identify 78,729 EPS forecasts issued between 2006 and 2014 that have all necessary firm identifiers (PERMNO, GVKEY, CUSIP, and I/B/E/S ticker).[8] We drop 4,997 observations categorized as earnings "pre-announcements" (or earnings guidance issued between fiscal period end and the earnings announcement date for that period) and 2,133 open-ended or qualitative forecasts for which we cannot measure *MEF_Accuracy*. We rely on Execucomp for compensation-related measures, which results in another 27,264 deletions. Finally, we lose an additional 9,329 observations due to missing control variables. Our primary sample begins with the remaining 35,006 observations. Certain tests have smaller samples due to additional sample restrictions.

Panel B of Table 1 displays the distribution of our sample across industries. Consistent with prior research (e.g., Baginski et al. 2018), nearly half of our observations (49 percent) come from Manufacturing. We also have a reasonable number of observations from Services (20 percent), Retailing (13 percent), and Telecommunications, Transportation, Utilities (10 percent). Remaining industries each have less than 5 percent of observations. Panel C displays our sample by year. The number of forecasts per year is relatively static, with most years having 3,500 to 4,500 observations.

Table 2 presents descriptive statistics for all variables used in our study. Our primary dependent variable, *MEF_Accuracy,* is uniformly negative since we multiply the traditional measure of absolute forecast error by −1 (and by 100 for scaling purposes). Consistent with prior research, we observe relatively small forecast errors (or relatively high accuracy). The mean and median values for *MEF_Accuracy* are approximately 0.9 and 0.3 percent of price, respectively. These values are very similar to statistics reported in Yang (2012). Our primary independent variables, *SeverancePay* and *Vega,* also conform to prior research. For instance, our mean (median) value for *SeverancePay* is 0.072 (0.037), which is very similar to the 6.8 (3.3) reported in Baginski et al. (2018) after accounting for the fact that we scale our measure by 100 to facilitate coefficient presentation. Given that we use Execucomp for compensation data, our sample of firms are relatively large, with median market capitalization of 2.6 billion ($e^{7.88}$) and institutional ownership of 81 percent. Quarterly forecasts of earnings comprise 35 percent of our sample.

IV. UNIVARIATE ANALYSIS

We begin our analyses with simple univariate evidence. If managers have private information about future earnings they wish to convey, it is reasonable to expect their first forecast for a given period (i.e., the forecast with the longest horizon) goes more directly to the ultimate actual earnings amount. In other words, if severance pay and vega encourage managers to reveal their private information, we expect managers with higher levels of these contracts are (1) *initially* more accurate with their forecasts and (2) *remain* more accurate with their forecasts.

To provide descriptive evidence on this conjecture, Table 3 partitions the sample of annual forecasts into four compensation groups: (1) managers with upper-quartile severance and upper-quartile vega ("*High Severance/High Vega*"), (2) managers with upper-quartile severance but without upper-quartile vega ("*High Severance/Low Vega*"), (3) managers without upper-quarter severance but with upper-quartile vega ("*Low Severance/High Vega*"), and (4) managers without upper-quartile severance or vega ("*Low Severance/Low Vega*").[9] We also partition the sample depending on how far in advance the forecast is made, falling into four horizon categories (four or more quarters in advance, three quarters in advance, two quarters in advance, and one quarter in advance).

In Panel B of Table 3 (and in Figure 1), we track how forecast accuracy changes for each sample partition as the horizon of the forecast changes from four quarters in advance to one quarter in advance. We find forecast accuracy improves across all sample partitions as the forecast date gets closer to the actual earnings announcement date. Panels C and D provide comparisons relative to the "*High Severance/High Vega*" group. Panel C shows that forecasts for managers in the "*Low Severance/Low Vega*" category are about 50 percent less accurate than forecasts for managers in the "*High Severance/High Vega*" category—regardless of the forecast horizon. Further, the decrease in forecast accuracy in the "*High Severance/Low Vega*" is significantly larger than the decrease for the "*Low Severance/High Vega*" group, suggesting vega may be an economically more powerful driver of forecast accuracy. Panel D provides statistical tests of differences of Panel B, providing further support for our inferences.[10] Overall, Table 3 provides initial evidence that managers with higher levels of severance pay and vega are *initially* more accurate with their forecasts, and also *remain* more accurate with their forecasts.

[8] Our sample begins in 2006 because this is the first year for which severance pay data are systematically available.

[9] Our sample consists of both quarterly and annual horizon forecasts. For this analysis, we limit our sample to annual earnings forecasts because annual forecasts have more variation in horizon. In subsequent tests, we include both quarterly and annual forecasts, and we report results separately for annual forecasts as well.

[10] In Panel A of Table 3, we find that about ten percent of sample managers have *both* high severance and high vega (i.e., about 550 out of 5,500 manager-year combinations). Interestingly, this proportion does not change across the various forecast horizons. This observation suggests that severance and vega are not related to the forecast horizon (in isolation).

TABLE 1

Sample Selection, Industry Composition, and MEF by Year

Panel A: Sample Selection Procedure

Management earnings forecasts (MEF) for fiscal years 2006–2014 issued by firms with PERMNO, CUSIP, GVKEY, and I/B/E/S TICKER	78,729
Less:	
Earnings pre-announcements	(4,997)
Open ended or qualitative MEF	(2,133)
Those without the CEO's compensation information on Execucomp	(27,264)
Missing necessary control variable information	(9,329)
Management earnings forecasts for empirical tests	35,006

Panel B: Industry Composition

Two-Digit SIC Industry Sector	Number of MEF	Percent of MEF
Agriculture (01–09)	—	0.00%
Mining (10–14)	400	1.14%
Construction (15–17)	412	1.18%
Manufacturing (20–39)	17,445	49.83%
Telecommunication, Transportation, Utilities (40–49)	3,595	10.27%
Wholesale (50–51)	1,162	3.32%
Retailing (52–59)	4,457	12.73%
Financial (60–69)	518	1.48%
Services (70–88)	6,970	19.91%
Other	47	0.13%
Total	35,006	100.00%

Panel C: MEF by Year

Year	Number of MEF	Percent of MEF
2006	3,237	9.25%
2007	4,206	12.02%
2008	4,354	12.44%
2009	3,449	9.85%
2010	4,004	11.44%
2011	3,947	11.28%
2012	4,024	11.50%
2013	3,966	11.33%
2014	3,819	10.91%
Total	35,006	100.00%

Table 1 presents sample information. Panel A presents sample attrition and Panel B (C) presents sample distribution by industry (year).

V. MULTIVARIATE RESULTS

Test of H1a and H1b

Table 4 presents our multivariate regression results for H1a and H1b. In the first column, we present full sample results. In the second column, we present results for a subset of "meaningful" forecasts. Following Kothari et al. (2009), we define a forecast as meaningful if forecast news is at least five cents per share and exceeds 1 percent of the analyst consensus at the forecast date. As previously mentioned, H1a predicts a positive coefficient on *SeverancePay*, and H1b predicts a positive coefficient on *Vega*.

TABLE 2

Descriptive Statistics

Variable	n	Mean	Std. Dev.	Lower Quartile	Median	Upper Quartile
MEF_Accuracy	35,006	−0.900	1.981	−0.811	−0.297	−0.100
MEF_Bias	35,006	0.162	1.573	−0.285	−0.009	0.314
AF_Accuracy	34,850	−0.665	1.519	−0.575	−0.210	−0.072
AF_Dispersion	34,850	0.046	0.054	0.020	0.030	0.050
SeverancePay	35,006	0.072	0.097	0.000	0.037	0.097
Vega	35,006	0.146	0.164	0.024	0.092	0.206
Delta	35,006	0.548	0.795	0.130	0.293	0.606
InstitutionOwn	35,006	0.757	0.237	0.690	0.815	0.913
Size	35,006	7.956	1.434	6.929	7.888	8.942
AFollow	35,006	9.110	5.100	5.308	8.083	11.833
MB	35,006	3.204	3.028	1.629	2.412	3.674
IndustryConc	35,006	0.446	0.181	0.328	0.395	0.519
LitRisk	35,006	0.199	0.400	0.000	0.000	0.000
Tenure	35,006	6.595	5.968	2.000	5.000	9.000
AccrQuality	35,006	−0.024	0.016	−0.030	−0.020	−0.013
Qtr	35,006	0.350	0.477	0.000	0.000	1.000
Horizon	35,006	0.529	0.277	0.219	0.518	0.775
Volatility	35,006	0.638	0.839	0.160	0.372	0.761

Consistent with H1a, we observe significantly positive coefficients on *SeverancePay* in both columns. When managers have greater severance pay, they provide forecasts that are more accurate, consistent with the role of severance pay as a mechanism through which shareholders can encourage managers to reveal more of their private information. Consistent with H1b, we observe significant, positive coefficients on *Vega* in both columns. When managers' stock options have greater sensitivity to stock price volatility, managers provide forecasts that are more accurate, supporting the role of stock options as a mechanism through which shareholders can encourage managers to reveal more of their private information.[11,12]

Our results are not only statistically significant, but they are also economically significant. A one-standard deviation increase in *SeverancePay* (*Vega*) corresponds to an improvement in *MEF_Accuracy* of between 6.0 and 6.7 percent (6.1 and 6.4 percent). As a point of comparison, a one-standard deviation increase in *Size,* a well-accepted determinant of forecast accuracy (Waymire 1985), corresponds to an improvement in forecast accuracy of 9.7 to 11.8 percent.[13]

We also comment on *Delta*. Opposite to the effects of *SeverancePay* and *Vega,* we observe a marginally *negative* association between *Delta* (the sensitivity of a CEO's wealth to changes in stock price) and *MEF_Accuracy* on the full sample of firms (i.e., Column [1]). As discussed in Section II, when managers are more concerned with the *level* of stock price (as opposed to the *volatility* of it), they are more likely to conceal their private information (rather than to reveal it). In this sense, option-derived incentives do not appear to universally promote the sharing of a manager's private information.

Test of H2a and H2b

Recall that H2a and H2b predict that the effects related to severance and stock option vega (H1a and H1b, as documented in Table 4) will be stronger in the face of high short-term performance pressure. As previously discussed, we use two measures that proxy for performance pressure: (1) the level of transient institutional ownership and (2) the level of the CEO's career concerns. For transient institutional ownership, we partition the sample at the median and consider firms above (below) this

[11] Recall that we scale *SeverancePay* and *Vega* by total compensation. Our results are similar if we instead log these variables rather than scale them (untabulated).

[12] As an additional test, we re-estimate the results in Table 4, replacing *SeverancePay* and *Vega* with *SeverancePay_High* and *Vega_High,* which are indicator variables equal to 1 if the manager has *SeverancePay* and *Vega* in the upper quartile, respectively. Consistent with our primary inferences, the coefficient on both indicator variables is positive and significant. However, we do not find a significant coefficient on the interaction of *SeverancePay_High* and *Vega_High* (untabulated).

[13] Prior studies find that CEOs *and* CFOs are responsible for the firm's interactions with the investment community (e.g., Anderson, Duru, and Reeb 2009; Bamber et al. 2010). Examining CFO compensation, we find our primary results hold, although results are economically and statistically weaker (untabulated).

TABLE 3

Management Forecast Accuracy and Horizon

Panel A: Number of Observations

	> 270 Days	180–269 Days	90–179 Days	< 90 Days
High Severance/High Vega	548	580	526	527
High Severance/Low Vega	893	886	875	879
Low Severance/High Vega	930	875	847	877
Low Severance/Low Vega	3,461	3,336	3,297	3,422
Total	5,832	5,677	5,545	5,705

Panel B: *MEF_Accuracy*

	> 270 Days	180–269 Days	90–179 Days	< 90 Days
High Severance/High Vega	−0.68	−0.56	−0.38	−0.25
High Severance/Low Vega	−1.30	−1.11	−0.86	−0.63
Low Severance/High Vega	−0.79	−0.64	−0.52	−0.33
Low Severance/Low Vega	−1.34	−1.10	−0.86	−0.58
Average	−1.03	−0.85	−0.66	−0.45

Panel C: Comparisons Relative to the "*High Severance/High Vega*" Group—Percent Decrease in Accuracy

Percent Decrease in Accuracy	> 270 Days	180–269 Days	90–179 Days	< 90 Days
High Severance/Low Vega	48%	50%	56%	60%
Low Severance/High Vega	15%	13%	26%	24%
Low Severance/Low Vega	49%	49%	55%	56%

Panel D: Comparisons Relative to the "*High Severance/High Vega*" Group—Test of Differences

Test of Differences	> 270 Days	180–269 Days	90–179 Days	< 90 Days
High Severance/Low Vega	−0.63***	−0.55***	−0.48***	−0.38***
Low Severance/High Vega	−0.13*	−0.09*	−0.14**	−0.08
Low Severance/Low Vega	−0.66***	−0.54***	−0.48***	−0.32***

***, **, * Denote significance at the $p < 0.01$, $p < 0.05$, and $p < 0.10$ levels, respectively.

Table 3 presents management forecast accuracy of forecasts of annual earnings, by horizon and compensation. The variable presented is *MEF_Accuracy* (where a larger number indicates a more accurate forecast). "High" = 1 if the compensation measure is in the upper quartile of the sample, and "Low" otherwise. Panel A presents the number of observations in each group. Panel B presents the value of *MEF_Accuracy* for each group. Panel C presents comparisons to the "*High Severance/High Vega*" group. Panel C shows economic differences by comparing the percent decrease in accuracy relative to the "*High Severance/High Vega*" group. Panel D presents tests of statistical differences in *MEF_Accuracy* relative to the "*High Severance/High Vega*" group.

point in the "high" ("low") partition. For each proxy, we utilize a fully interacted model, focusing on the interactions between both *SeverancePay* and *Vega* and our high-pressure variable. Our high-pressure variable (i.e., *High_TransOwn* or *High_CareerConcerns*) takes the value 1 when the firm faces relatively higher short-term performance pressure (i.e., has higher transient institutional ownership or higher career concerns).

Table 5 reports our results from this analysis.[14] Panel A reports results for transient institutional ownership, and Panel B for career concerns. For ease of exposition, we only include main effects of and interactions with variables of interest (e.g., *High_*

[14] We present results using a fully interacted regression model. If we only interact our variables of interest with the capital market pressure measures, our results are unaffected.

FIGURE 1
Management Forecast Accuracy by Horizon

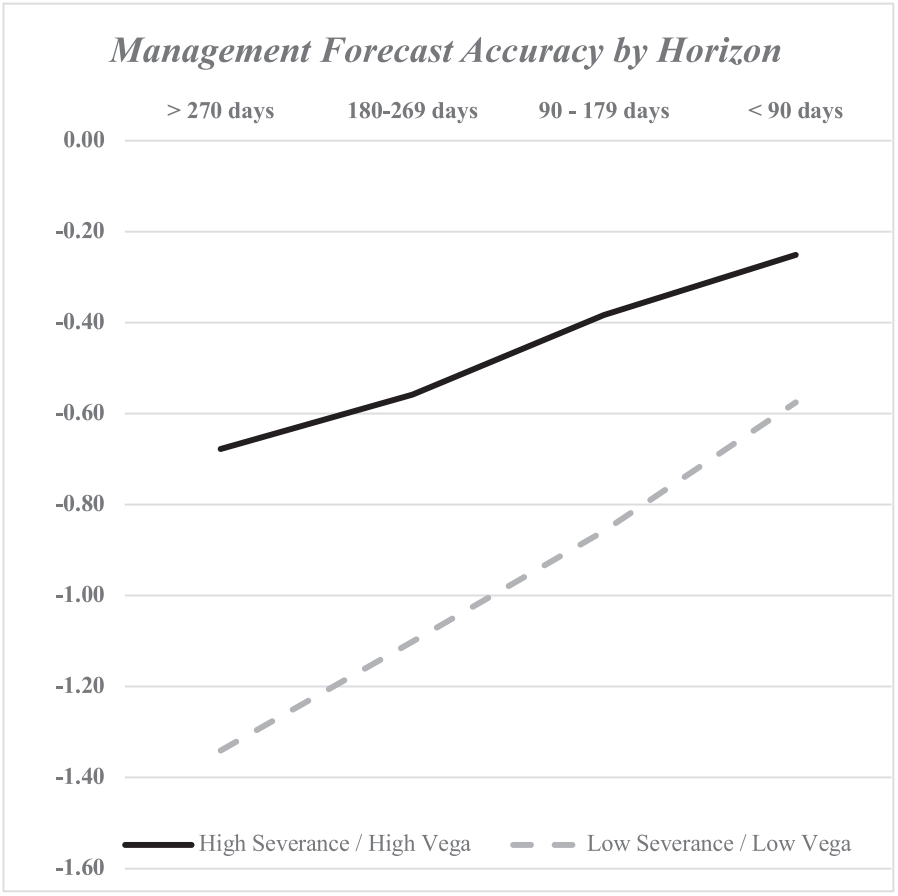

Figure 1 presents *MEF_Accuracy* for the "*High Severance*/*High Vega*" and "*Low Severance*/*Low Vega*" groups presented in Panel B of Table 3.

TransOwn, SeverancePay, and *Vega*). Beginning with Panel A (where transient institutional ownership is our proxy for short-term performance pressure), we observe evidence consistent with our predictions in H2a and H2b. Specifically, the association between *MEF_Accuracy* and both *SeverancePay* and *Vega* is significantly stronger in the *High_TransOwn* partition, (i.e., when the firm is above the sample median for transient institutional ownership). In fact, in the full sample, the effect of *SeverancePay* is insignificant for firms in the low-pressure group, and the effect of *Vega* is reduced. These results suggest the benefits of severance and vega are concentrated in firms that face high short-term performance pressure (i.e., when, absent incentives generated by vega and severance pay, the manager likely has stronger incentives to withhold private information).

In Panel B, where we measure high short-term performance pressure using career concerns, we observe similar (albeit weaker) evidence for severance and vega. Specifically, the forecast accuracy of firms whose managers face higher career concerns (*High_CareerConcerns* = 1) are more affected by *SeverancePay* and *Vega*. The interaction between *SeverancePay* and *High_CareerConcerns* is significantly positive in the full sample, and the interaction between *Vega* and *High_CareerConcerns* is significantly positive in both the full sample and the meaningful forecasts sample.[15] Taken together, the evidence in Table 5 supports the notion that the benefits of severance and option vega are concentrated in firms (and managers) that face high short-term performance pressure. That is, these contracts are most important when management's focus might otherwise be on short-term results and thus, they face greater incentives to withhold private information.

[15] To identify managers with high career concerns, we utilize seven career concern proxies to employ a PCA that identifies managers who face higher career concerns. However, one of these seven measures is defined based on compensation features (*Pay-for-performance sensitivity)*. Our results are similar if we re-measure career concerns without pay-for-performance-sensitivity included in the PCA (untabulated).

TABLE 4

Test of H1a and H1b
Management Earnings Forecast Accuracy

		Dependent Variable: *MEF_Accuracy*	
	Pred. Sign	**(1) Full Sample**	**(2) Meaningful Forecasts**
SeverancePay	+ (H1a)	0.563**	0.628**
		(0.29)	(0.30)
Vega	+ (H1b)	0.351***	0.333**
		(0.12)	(0.13)
Delta	−	−0.041*	−0.026
		(0.03)	(0.03)
InstitutionOwn	+	0.676***	0.696***
		(0.24)	(0.27)
Size	+	0.655***	0.608***
		(0.09)	(0.09)
AFollow	?	−0.022***	−0.022***
		(0.01)	(0.01)
MB	+	0.019**	0.022**
		(0.01)	(0.01)
IndustryConc	?	0.382	0.364
		(0.55)	(0.58)
LitRisk	?	0.114	0.097
		(0.09)	(0.10)
Tenure	+	0.002	0.002
		(0.00)	(0.01)
AccrQuality	?	0.851	1.791
		(1.79)	(1.89)
Qtr	+	0.145***	0.098*
		(0.05)	(0.05)
Horizon	−	−0.922***	−1.027***
		(0.04)	(0.05)
Volatility	−	−0.060**	−0.058**
		(0.03)	(0.03)
Observations		35,006	26,646
Adjusted R^2		0.587	0.606
Fixed Effects		Firm and Year	Firm and Year

***, **, * Denote significance at the $p < 0.01$, $p < 0.05$, and $p < 0.10$ levels, respectively.
Table 4 presents coefficients (standard errors) for tests of H1a and H1b. Robust standard errors are clustered by firm. Significance levels are based on one-tailed (two-tailed) p-values when coefficients are predicted (not predicted).
All variables are defined in Appendix A.

Recall that Nagar et al. (2003) suggest managers are reluctant to reveal their private information because (1) disclosure can cause the labor market to reassess managerial ability and thus managers are reluctant to disclose if they are uncertain how such disclosures will reflect upon them, and (2) less disclosure makes it more difficult for investors to discipline managers, which leads to entrenchment. Our cross-sectional test on career concerns is consistent with the first disclosure agency problem from Nagar et al. (2003) (i.e., managers with greater career concerns are more concerned about labor market evaluations of ability, and thus when severance pay and vega have the greatest opportunity to encourage forthcoming disclosure). Regarding Nagar et al.'s (2003) second reason (related to entrenchment), it's possible that entrenchment alters the incentives induced by convex compensation contracts. On the one hand, entrenchment may capture the inverse of career concerns and dampen managers' sensitivity to these incentives. On the other hand, entrenched managers may have more private information, which leads to more concerted efforts by principals to extract that information, potentially through compensation contract design. In untabulated analysis, we consider whether results for severance and vega vary depending on entrenchment status, as measured in Bebchuk, Cohen, and Ferrell

TABLE 5
Test of H2a and H2b

Panel A: High Pressure Based on Transient Institutional Ownership

		Dependent Variable: *MEF_Accuracy*	
	Pred. Sign	**(1) Full Sample**	**(2) Meaningful Forecasts**
High_TransOwn		0.849***	1.002***
		(0.20)	(0.24)
SeverancePay		0.044	0.071
		(0.16)	(0.19)
Vega		0.264**	0.235*
		(0.10)	(0.12)
High_TransOwn × *SeverancePay*	+ (H2a)	1.043***	1.041***
		(0.20)	(0.23)
High_TransOwn × *Vega*	+ (H2b)	0.239**	0.243*
		(0.14)	(0.16)
Observations		35,006	26,646
Adjusted R^2		0.588	0.608
Fixed Effects		Firm and Year	Firm and Year
Controls		Yes	Yes

Panel B: High Pressure Based on Career Concerns

	Pred. Sign	**(1) Full Sample**	**(2) Meaningful Forecasts**
High_CareerConcerns		-0.733***	-0.690***
		(0.22)	(0.26)
SeverancePay		0.644***	0.639***
		(0.16)	(0.19)
Vega		0.278**	0.235*
		(0.11)	(0.14)
High_CareerConcerns × *SeverancePay*	+ (H2a)	0.250	0.371*
		(0.22)	(0.26)
High_CareerConcerns × *Vega*	+ (H2b)	0.197*	0.264*
		(0.14)	(0.17)
Observations		27,932	21,253
Adjusted R^2		0.645	0.660
Fixed Effects		Firm and Year	Firm and Year
Controls		Yes	Yes

***, **, * Denote significance at the $p < 0.01$, $p < 0.05$, and $p < 0.10$ levels, respectively.

Table 5 presents coefficients (standard errors) for tests of H2a and H2b. Panel A presents results partitioning on transient institutional ownership (*High_TransOwn* = 1 if transient institutional ownership is above the sample median). Panel B presents results partitioning on Career Concerns (*High_CareerConcerns* = 1 if the PCA of seven career concerns measures is above the sample median). We employ the seven career concern measures used in Baginski et al. (2018): Young CEO, Retiring CEO, New CEO, Outside CEO, CEO Duality, Pay-for-performance sensitivity, and High Volatility. For brevity, we only include variables of interest and associated interactions, but all variables included in Table 4, as well as interactions with High Pressure, are included in Table 5. Robust standard errors are clustered by firm. Significance levels are based on one-tailed (two-tailed) p-values when coefficients are predicted (not predicted).

All variables are defined in Appendix A.

(2009). We do not find significant differences at the median, but we do find some evidence that the relation between severance (but not vega) and forecast accuracy is attenuated for managers with very high entrenchment index values.[16] This provides some evidence consistent with the argument that entrenchment may render compensation incentives related to severance less effective.

VI. ROBUSTNESS AND ADDITIONAL ANALYSES

Alternative Explanation—Earnings Management

An alternative explanation for our findings is that managers with higher levels of severance pay and vega engage in financial misreporting (e.g., earnings management) to manage to an "accurate" forecast. Regarding severance pay, prior research suggests that managers with more severance pay manage earnings *less*. Thus, it is unlikely our results for severance pay are driven by earnings management. However, prior research finds a *positive* relation between vega and financial misreporting (Armstrong et al. 2013), suggesting this alternative explanation is plausible. Although we control for accruals quality in our main analyses (as in prior research such as Ke, Li, Ling, and Zhang 2019) and prior literature suggests firms that forecast (like our sample) are less likely to engage in earnings management (e.g., Dye 1988; Schipper 1989; Jo and Kim 2007), it is still possible that our results for vega could be driven by this alternative explanation. We discuss a number of untabulated results that suggest our stock option vega results are unlikely to be driven by earnings management.

First, we replicate the Armstrong et al. (2013) Table 3 result which documents a positive relation between stock option vega and absolute discretionary accruals. Then, we split the sample into firms that do and do not provide forecasts. We find robust evidence that the positive relation between absolute discretionary accruals and vega is only present for firms that do not provide forecasts. Second, and similarly, we regress absolute discretionary accruals on stock option vega for firms in *our sample* (rather than one constructed as in Armstrong et al. 2013) and find no significant association, further suggesting no relation between option vega and earnings management in our sample. Third, following Hutton et al. (2012) we replicate our Table 4 results after excluding firms that do not revise their initial forecast at least once. The intuition is that managers who do not revise their first forecast are more likely to be held to this forecast, and thus more likely to engage in earnings management to meet the forecast. In both columns, the coefficients on both *SeverancePay* and *Vega* remain positive and significant, suggesting our inferences hold after excluding firms who are more likely to engage in earnings management to meet their earnings forecast. Finally, we re-estimate Equation (1) using managers' *sales* forecast accuracy as the dependent variable because prior research suggests revenues are less vulnerable to manipulation by management (Ertimur et al. 2003; Koo and Lee 2018). *Vega* remains positive and significant in both columns. Overall, the results of our robustness tests support the conclusion that earnings management is not likely driving our main findings.

A Discussion on Causality

Causality is a concern for archival studies (particularly for voluntary disclosure and compensation studies), and ours is no exception. Although we include control variables to address identifiable variables that relate to both compensation and management forecast accuracy and we employ firm fixed effects, it is possible a time varying correlated omitted variable remains or that reverse causality is of concern.[17] We can never fully rule out concerns over causality, but in this section we provide additional evidence to help support (though not ensure) causal inference.

We first perform a changes analysis. Table 6, Panel A reports results. The coefficient on *SeverancePay* and *Vega* is positive and significant in both columns. Next, we lag our compensation variables by one year to ensure the compensation features have time to influence management forecast decisions (note that our primary analysis uses compensation features at the beginning of the current year). Table 6, Panel B presents results. The coefficient on both *lag_SeverancePay* and *lag_Vega* is significantly positive in both columns and of similar economic magnitude to our primary results. Finally, as a falsification test, we *lead* our compensation variables by one year (i.e., we test for an association between current year forecast accuracy and next year compensation). If compensation affects future forecasting decisions, we should find no association between current forecast accuracy and next period's compensation. Table 6, Panel C presents results, showing that coefficient on both *lead_SeverancePay* and *lead_Vega* falls well below conventional significance thresholds.

Next, we perform matching procedures using entropy balancing (e.g., McMullin and Schonberger 2020). The idea is to identify firms with characteristics that predict similar levels of compensation but have differing levels of compensation. We

[16] The index varies between 0 and 6. The sample median is 4. Eighteen percent of the sample has indices of 5 or 6, which is where we find the most consistent evidence that the relation between severance and forecast accuracy weakens.

[17] For example, with respect to reverse causality, although prior research is largely silent on whether forecasting behavior can cause compensation changes, Hui and Matsunaga (2015) find that changes in voluntary disclosure quality lead to changes in a different type of compensation (annual bonuses).

TABLE 6
Alternative Specifications

Panel A: Changes Specification

		Dependent Variable: Δ*MEF_Accuracy*	
	Pred. Sign	**[1] Full Sample**	**[2] Meaningful Forecasts**
Δ*SeverancePay*	+ (H1a)	1.281**	1.199*
		(0.58)	(0.72)
Δ*Vega*	+ (H1b)	0.879**	1.212***
		(0.35)	(0.46)
Observations		31,769	24,157
Adjusted R^2		0.248	0.251
Fixed Effects		Year	Year
Controls		Yes	Yes

Panel B: Lagging Compensation Variables

		Dependent Variable: *MEF_Accuracy*	
	Pred. Sign	**[1] Full Sample**	**[2] Meaningful Forecasts**
lag_SeverancePay	+ (H1a)	0.658**	0.689**
		(0.32)	(0.32)
lag_Vega	+ (H1b)	0.268***	0.229**
		(0.11)	(0.12)
Observations		31,769	24,157
Adjusted R^2		0.578	0.591
Fixed Effects		Firm and Year	Firm and Year
Controls		Yes	Yes

Panel C: Leading Compensation Variables

		Dependent Variable: *MEF_Accuracy*	
	Pred. Sign	**[1] Full Sample**	**[2] Meaningful Forecasts**
lead_SeverancePay	0	0.346	0.474
		(0.38)	(0.42)
lead_Vega	0	0.170	0.146
		(0.13)	(0.16)
Observations		31,187	23,759
Adjusted R^2		0.594	0.615
Fixed Effects		Firm and Year	Firm and Year
Controls		Yes	Yes

***, **, * Denote significance at the $p < 0.01$, $p < 0.05$, and $p < 0.10$ levels, respectively.

Table 6 presents coefficients (standard errors) for alternative specifications of tests of H1a and H1b. Panel A presents results for our main test (i.e., Table 4) using a changes specification. Panel B presents results for our main test using lagged (by one year) measures of compensation. Panel C presents results for our main test using lead (by one year) measures of compensation. For brevity, we only include variables of interest, but all variables included in Table 4 are included in Table 6. Robust standard errors are clustered by firm. Significance levels are based on one-tailed (two-tailed) p-values when coefficients are predicted (not predicted).

All variables are defined in Appendix A.

follow Armstrong et al. (2013) who dichotomize option vega into a discrete variable. Note that because we have two variables of interest (severance pay and vega), we perform matching procedures for each variable. For each variable, we employ entropy balancing to balance covariates on observable factors. Our results are similar when using this approach (untabulated).

Finally, another alternative explanation for our findings is that managers who receive severance and option contracts with higher vega are of higher ability than managers who do not (i.e., manager ability is a correlated omitted variable). That is, there may exist an innate component to the manager that simultaneously leads to these compensation contracts as well as more accurate forecasts. We address this issue in three untabulated sets of analyses. First, all of our results hold after we control for managerial ability (Feng et al. 2009; Demerjian, Lev, Lewis, and McVay 2013; Ittner and Michels 2017).[18] Second, all of our results hold after we control for all known determinants of severance and option contracts, suggesting that it is contracting with the manager (rather than manager attributes themselves) that leads managers to be more accurate in their voluntary disclosures. Third, our results hold when we replace firm fixed effects with manager fixed effects, suggesting that time-invariant manager attributes do not explain our results.

Overall, these tests reduce the likelihood that our results are explained by correlated omitted variables or reverse causality, but are instead due to the act of writing these compensation contracts with the manager.

Distinguishing Between Types of Managerial Risk Aversion

As previously discussed, managers are naturally risk-averse with respect to two types of risk—(1) downside risk (i.e., left-tail risk) and (2) overall risk (i.e., earnings and stock return volatility risk). In this section, we design tests to determine how severance pay and vega affect each of these types of risk. We do so through two separate tests.

First, we examine the relation between these compensation incentives and the extent to which managers reduces the *bias* in their forecasts. Prior research establishes that managers have a tendency to be optimistic with their voluntary disclosures (e.g., Hribar and Yang 2016), and have a general tendency to withhold bad news (e.g., Kothari et al. 2009; Baginski et al. 2018). If severance pay and vega reduce managers' concerns over downside (i.e., left-tail) risk, these contracts should reduce managers' disclosure optimism, leading to a more truthful, unbiased, and accurate disclosure policy. Table 7, Panel A presents results for Equation (1) where we replace the dependent variable with management forecast *MEF_Bias*. Consistent with these contracts reducing managerial optimism, we observe significant, negative coefficients on *SeverancePay* and *Vega* in both columns. These results suggest severance and vega reduce managers' concerns over left-tail risk, leading to more truthful and unbiased disclosures.

Second, we partition the sample into good and bad news forecasts. If our main results hold separately, we can infer from the bad news results that greater severance and vega motivate managers to reveal private information about downside (or left-tail) risk, and from the good news results that managers are motivated to reveal private information about upside volatility as well.

Table 7, Panel B presents results from estimating Equation (1) separately for good and bad news forecasts (using the *News* variable) and uses *MEF_Accuracy* as the dependent variable. Columns (1) and (2) present results for good news forecasts, while Columns (3) and (4) present results for bad news forecasts. Overall, we find evidence that both severance pay and vega are associated with forecast accuracy in each subsample. However, it is notable that the economic significance is stronger in the bad news subsample, consistent with these compensation contracts having a stronger effect on managers' downside risk. Overall, results are consistent with severance pay and vega reducing managers' concerns over both (1) downside risk and (2) overall volatility risk.

Alternative Proxies for Management Forecast Accuracy

Calculating management forecast accuracy requires the researcher to specify the manager's mean expectation in a range forecast (e.g., median, upper bound, etc.) and does not incorporate user knowledge of known management-specific biases (Hilary, Hsu, and Wang 2014). Accordingly, we rely on the fact that *analyst* forecast characteristics are related to their ratings of the quality of a firm's disclosures (e.g., Lang and Lundholm 1996) and that analysts incorporate management forecast information quickly into their forecasts (e.g., Hassell and Jennings 1986; Cotter, Tuna, and Wysocki 2006). We examine two measures of analyst forecasts: (1) accuracy of consensus analyst forecasts and (2) analyst forecast dispersion, both measured immediately *following* the management forecast. These proxies define the extent to which managers reveal private information conditioned on the user information set. For example, if analysts know a manager consistently reports actual earnings, say, two

[18] We thank Peter Demerjian for making public his measure of managerial ability.

TABLE 7

Additional Analyses

Panel A: Management Earnings Forecast Bias

		Dependent Variable: *MEF_Bias*	
	Pred. Sign	**[1] Full Sample**	**[2] Meaningful Forecasts**
SeverancePay	−	−0.754***	−0.817***
		(0.25)	(0.28)
Vega	−	−0.396***	−0.387**
		(0.14)	(0.17)
Observations		35,006	26,646
Adjusted R^2		0.338	0.356
Fixed Effects		Firm and Year	Firm and Year
Controls		Yes	Yes

Panel B: Management Earnings Forecast Accuracy Partitioned on Sign of News

		Dependent Variable: *MEF_Accuracy*			
		Good News		*Bad News*	
	Pred. Sign	**[1] Full Sample**	**[2] Meaningful Forecasts**	**[3] Full Sample**	**[4] Meaningful Forecasts**
SeverancePay	+	0.443**	0.577**	0.944**	0.939**
		(0.26)	(0.32)	(0.47)	(0.46)
Vega	+	0.264**	0.236**	0.638***	0.703***
		(0.12)	(0.14)	(0.18)	(0.19)
Observations		25,306	19,288	9,700	7,358
Adjusted R^2		0.538	0.554	0.653	0.683
Fixed Effects		Firm and Year	Firm and Year	Firm and Year	Firm and Year
Controls		Yes	Yes	Yes	Yes

***, **, * Denote significance at the $p < 0.01$, $p < 0.05$, and $p < 0.10$ levels, respectively.
Table 7 presents coefficients (standard errors) for additional analyses. In Panel A, the dependent variable is *MEF_Bias*. In Panel B, the dependent variable is *MEF_Accuracy*, and the sample is partitioned based on good and bad news earnings forecasts. For brevity, we only include variables of interest and associated interactions, but all variables included in Table 4 are included in Table 7. Robust standard errors are clustered by firm. Significance levels are based on one-tailed (two-tailed) p-values when coefficients are predicted (not predicted).
All variables are defined in Appendix A.

cents above the mean of their range forecast, analysts will adjust accordingly to capture managers' private information revelation (Hilary et al. 2014).[19]

Table 8, Panel A presents results using *AF_Accuracy* as the dependent variable. Consistent with our main results using management forecast accuracy, *SeverancePay* and *Vega* exhibit significantly positive associations with *AF_Accuracy* in both columns. Analyst forecast accuracy is higher when the forecasting manager has higher levels of severance pay and option vega.

[19] An alternative approach to analyst forecast characteristics is to use measures of investor responses. We consider (1) information asymmetry and (2) price response. First, Coller and Yohn (1997) find management forecasts reduce information asymmetry. In untabulated analysis, we find information asymmetry (proxied for using bid-ask spread) decreases more after forecasts from managers with greater severance pay and vega. Second, we examine price reactions to forecasts and find no effect of severance or vega in changing price reactions to forecast news. Price reactions comingle changes in expectations of current earnings, future earnings, and the discount rate. Additionally, in recent years, approximately 90 percent of forecasts are issued contemporaneously with an earnings announcement (Rogers and Van Buskirk 2013; Baginski, Campbell, Ryu, and Warren 2022), further complicating a price reaction test. Finally, unlike analyst forecasts, price reactions are not measured with respect to subsequently revealed actual earnings.

TABLE 8

Analyst Forecast Properties

Panel A: Analyst Forecast Accuracy

		Dependent Variable: *AF_Accuracy*	
	Pred. Sign	**[1] Full Sample**	**[2] Meaningful Forecasts**
SeverancePay	+	0.589**	0.579**
		(0.24)	(0.25)
Vega	+	0.443***	0.433***
		(0.12)	(0.13)
Observations		34,850	26,637
Adjusted R^2		0.551	0.551
Fixed Effects		Firm and Year	Firm and Year
Controls		Yes	Yes

Panel B: Analyst Forecast Dispersion

		Dependent Variable: *AF_Dispersion*	
	Pred. Sign	**[1] Full Sample**	**[2] Meaningful Forecasts**
SeverancePay	−	−1.497*	−0.960
		(0.86)	(0.95)
Vega	−	−0.011**	−0.015***
		(0.01)	(0.01)
Observations		34,850	26,637
Adjusted R^2		0.592	0.595
Fixed Effects		Firm and Year	Firm and Year
Controls		Yes	Yes

***, **, * Denote significance at the $p < 0.01$, $p < 0.05$, and $p < 0.10$) levels, respectively.
Table 8 presents coefficients (standard errors) for additional analysis using the analyst forecast properties. Panel A presents results using analyst forecast accuracy (*AF_Accuracy*). Panel B presents results using analyst forecast dispersion (*AF_Dispersion*). Robust standard errors are clustered by firm. Significance levels are based on one-tailed (two-tailed) p-values when coefficients are predicted (not predicted).
All variables are defined in Appendix A.

These results are economically significant. A one-standard deviation in *SeverancePay* (*Vega*) corresponds to an increase in *AF_Accuracy* of approximately 6.4 percent (8.1 percent).

Panel B presents results using *AF_Dispersion*. The coefficient on *SeverancePay* (*Vega*) is negative and significant in one (both) columns. Although statistically weak for *SeverancePay,* these results suggest analyst forecast dispersion (a measure of analyst uncertainty) is smaller following forecasts from managers with greater amounts of severance pay and vega.

Other Forecast Attributes as Proxies for the Revelation of Private Information

Throughout our paper, we assume managers have private knowledge of their firms' future earnings performance, which motivates our use of forecast accuracy as a proxy for the extent to which managers reveal their private information. Prior research in management forecasting examines other attributes, such as forecast frequency and range. In this section, we consider the extent to which these alternative measures capture the extent to which managers reveal their private information and discuss results of additional tests related to these alternative measures.

Prior work examines the extent to which managers are likely to issue a forecast (i.e., forecast incidence and frequency). This measure is not ideal for our setting because forecast frequency does not consider whether the forecast that is provided is of high quality (i.e., it is possible to issue a lot of inaccurate forecasts, which can actually deteriorate the firm's information

environment). Furthermore, there are good reasons why managers might not issue an additional forecast, if they have no private information to reveal or if market expectations are correct and do not need to be revised (i.e., Ajinkya and Gift's [1984] Expectations Adjustment Hypothesis). In untabulated analysis, although we find no association between severance pay and forecast frequency, we do find that stock option vega is positively associated with forecast frequency.[20]

Prior work also considers forecast range. Recent research suggests that after Regulation Fair Disclosure nearly all forecasts take the form of "range" forecasts rather than "point estimates" so that managers can protect themselves from downside litigation risk through the lower point of their range (e.g., Rogers and Van Buskirk 2013). Furthermore, Ciconte et al. (2014) indicate that when managers provide a "range" forecast, their actual expectation (as well as investors' expectation) is the "upper bound" or top number in that range forecast. Consequently, in our tests of accuracy we use the "upper bound" as our estimate of a manager's earnings forecast. However, Jensen and Plumlee (2020) suggest that range conveys important information, so we consider forecast range as an additional dependent variable. In untabulated tests, we find no association between severance pay or stock option vega and forecast precision.

Finally, forecast horizon (i.e., how far in advance a manager is willing to forecast) is an attribute that could be considered as an alternative measure for the extent to which managers reveal their private information. Cross-sectional differences in horizon (in isolation) suffer from similar problems as forecast frequency (e.g., that either managers have no private information to reveal or that market expectations are correct and do not need to be revised). In untabulated results, we find no association between either severance or stock option vega and forecast horizon.

VII. CONCLUSION

We investigate whether common compensation features can encourage managers to reveal their private information. Under the assumption that managers have private knowledge of their firms' future earnings, we use management forecast accuracy to proxy for the extent to which managers reveal their private information and offer two main findings. First, both the amount of severance pay a manager receives and the convexity of their stock option portfolio (i.e., vega) are positively associated with that manager's forecast accuracy. This suggests that if shareholders compensate managers in ways that reduce concerns over firm volatility, they are more forthcoming with their private information. Second, these contracting incentives are more strongly associated with forecast accuracy when short-term pressure to conceal private information is higher. Additional analyses (1) suggest our results are unlikely explained by earnings management activity subsequent to the forecast, (2) provide circumstantial evidence in support of causality, (3) show managers with these contracting incentives issue less optimistically biased forecasts, and (4) document these contracts increase forecast accuracy of both good and bad news. Overall, our results suggest compensation can incent managers to provide more accurate disclosures, a clear benefit to capital market participants.

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[20] As previously mentioned, contemporaneous work by Cho, Tsui, and Yang (2021) documents a positive association between forecast frequency and option vega. Given the benefits and limitations of their disclosure proxy (forecast frequency) and our disclosure proxy (accuracy), we view our findings related to vega as complementary to Cho et al. (2021).

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APPENDIX A

Description of Variables Used in Analysis

Variable Name	Definition
Variables of Interest	
AF_Accuracy	Absolute difference between the consensus analyst forecast following the management forecast and actual earnings, multiplied by −100, scaled by beginning-of-the-period price [I/B/E/S].
AF_Dispersion	Analyst forecast dispersion following the management forecast of interest, defined as the standard deviation of all analysts' earnings forecasts [I/B/E/S].
MEF_Accuracy	Using the upper bound of the management forecast: absolute difference between the MEF and actual earnings, multiplied by −100, scaled by beginning-of-the-period price [I/B/E/S].
MEF_Bias	Using the upper bound of the management forecast: signed difference between the MEF and actual earnings, multiplied by −100, scaled by beginning-of-the-period price [I/B/E/S].
SeverancePay	CEO's *ex ante* severance pay at the beginning of the period, scaled by cash compensation, and scaled by 100 for presentation purposes [Execucomp].
Vega	The change in the value of the CEO's equity holdings due to a 0.01 change in stock-return volatility, scaled by cash compensation, measured at the beginning of the period. Calculated as: e ^ (−dT)N'(Z)ST ^ (0.5) ∗ (0.01), where: Z = [log(S/X) + T ∗ (r − d + ((s ^ 2)/2))]/(s ∗ (T ^ 0.5)); N = cumulative probability function for the normal distribution; S = price of the underlying stock; X = exercise price of the option; s = expected stock-return volatility over the life of the option; r = natural logarithm of risk-free interest rate; T = time to maturity of the option in years; d = natural logarithm of the expected dividend yield over the life of the option; and N'= normal density function.
Other Variables	
AccrQuality	The standard deviation of firm-level residuals from the Dechow and Dichev (2002) model during the years *t* −5 to *t*−1, multiplied by −1 [Compustat].
AFollow	Average number of analysts following the firm for the period forecasted by management [I/B/E/S].
Delta	The change in the value of the CEO's equity holding due to a 1 percent change in stock price, scaled by cash compensation, measured at the beginning of the period. Calculated as: e ^ (−dT) ∗ N(Z) ∗ (price/100), where: Z = [log(S/X) + T ∗ (r − d + ((s ^ 2)/2))]/(s ∗ (T ^ 0.5)); N = cumulative probability function for the normal distribution; S = price of the underlying stock; X = exercise price of the option; s = expected stock-return volatility over the life of the option; r = natural logarithm of risk-free interest rate; T = time to maturity of the option in years; d = natural logarithm of the expected dividend yield over the life of the option; and N'= normal density function.
Horizon	Number of days between the forecast date and the end of the fiscal period, scaled by 365 [I/B/E/S].
IndustryConc	A firm's market concentration, defined as sales of the top five firms in the two-digit SIC industry, divided by total sales in the same industry in year *t* [Compustat].

(continued on next page)

APPENDIX A (continued)

Variable Name	Definition
InstitutionOwn	Percent of shares held by institutions, measured as the average institutional ownership during the year in which the management forecast was released [Thompson Reuters].
LitRisk	Indicator variable equal to 1 if firm is in one of the following high-litigation risk industries: SIC codes 2833–2836 (biotech), 3570–3577 and 7370–7374 (computers), 3670–3674 (electronics), 5200–5961 (retailing), 8731–8734 (R&D service) and suffers a 20 percent or greater decrease in earnings, and 0 otherwise [Compustat].
MB	Market-to-book ratio at beginning-of-period [Compustat].
News	Forecast news, using the upper bound of the manager forecast for range forecasts, scaled by prior period stock price and, if bundled with earnings announcement, adjusted using the Rogers and Van Buskirk (2013) conditional analyst forecast adjustment for bundled forecasts.
Qtr	Indicator variable set equal to 1 for quarterly forecasts, and 0 otherwise [I/B/E/S].
Size	Natural logarithm of market value at beginning-of-the-period [Compustat].
Tenure	In years, how long the CEO has held his/her current title, measured in the year in which the management forecast was released [Execucomp].
Volatility	Standard deviation of earnings per share for the prior four periods. For quarterly forecasts, the standard deviation of quarterly earnings per share; for annual forecasts, the standard deviation of annual earnings per share [I/B/E/S].

Data sourced are referenced in brackets.