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Managers' pay duration and voluntary disclosures

Qiang CHENG
Singapore Management University, qcheng@smu.edu.sg

Young Jun CHO
Singapore Management University, yjcho@smu.edu.sg

Jae B. KIM
Lehigh University

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Qiang Cheng[1] Young Jun Cho[1] Jae B. Kim[2]

1 School of Accountancy, Singapore Management University, Singapore, Singapore

2 Department of Accounting, Lehigh University, Bethlehem, Pennsylvania, USA

Correspondence

Young Jun Cho, School of Accountancy, Singapore Management University, Singapore, Singapore.
Email: yjcho@smu.edu.sg

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Abstract

Given the adverse effect on their welfare, managers are reluctant to disclose bad news in a timely fashion. We examine the effect of managers' pay duration on firms' voluntary disclosures of bad news. Pay duration refers to the average period that it takes for managers' annual compensation to vest. We hypothesize and find that pay durations can incentivize managers to provide more bad news earnings forecasts. This result holds after controlling for the endogeneity of pay duration. In addition, we find that the effect of pay duration is more pronounced for firms with weaker governance and with poorer information environments, where the marginal benefits of additional disclosures are higher. We also find that these effects are stronger for firms facing lower litigation risk and for firms operating in more homogenous industries, where managers' ex-ante incentives to disclose bad news are particularly weak. Overall, we contribute to the literature by providing evidence that lengthening the vesting period of managers' compensation can induce managers to be more forthcoming with bad news.

KEYWORDS

executive compensation, management forecasts, pay duration, voluntary disclosure

JEL CLASSIFICATION G39, J33, M41

INTRODUCTION

We examine the effect of managers' pay duration on firms' voluntary disclosures. Pay duration refers to the average period that it takes for managers' annual compensation to vest. Using management earnings forecasts to capture voluntary disclosures, we investigate whether managers with long pay durations are more likely to issue bad-news earnings forecasts than those with short pay durations. We focus on bad news forecasts because managers generally disclose good news in a timely fashion but are reluctant to disclose bad news (e.g., Kothari et al., 2009). It is thus important to understand how managers can be incentivized to disclose bad news.

Our analyses are motivated by the observation that stock-based compensation may not align managers' interests with those of shareholders if the vesting period is short. In particular, Goldman

and Slezak (2006) find that stock-based compensation is a double-edged sword; it can induce managers to exert more effort to increase firm value, but it can also induce managers to engage in earnings management. In addition, while Armstrong et al. (2010) and Erickson et al. (2006) do not find a significant relation between equity incentives and earnings management, other studies find that stock-based compensation can motivate managers to pursue short-term gains at the expense of long-term firm value (e.g., Bergstresser & Philippon, 2006; Bolton et al., 2006; Cheng & Warfield, 2005; Efendi et al., 2007). In the disclosure setting, although Nagar et al. (2003) find that managers' equity incentives can mitigate disclosure-related agency conflicts and increase voluntary disclosures, Kothari et al. (2009) find that stock-based compensation can motivate managers to withhold bad news due to their concerns about short-term stock price drops.

Some researchers argue that to address managerial short-termism, executive compensation should be linked to firms' long-term performance. For example, Bebchuk and Fried (2010) argue that short-term pay arrangements are likely to have influenced the excessive risk-taking behavior of bank executives before the financial crisis and suggest a long horizon of executive compensation as one of the ways to address managerial myopia. A number of executives and government officials share the same view. For example, former Treasury Secretary Timothy Geithner (2009) argued, "Companies should seek to pay top executives in ways that are tightly aligned with the long-term value and soundness of the firm."[1]

Although lengthening pay duration can increase the long-term value of the firm by motivating managers to undertake long-term yet risky projects, it is costly. Because the risk that executives have to bear increases with the duration over which their compensation vests, risk-averse managers likely demand higher risk premiums when pay duration is longer. Thus, considering this trade-off, firms should determine pay duration based on various firm characteristics. Consistent with this notion, Gopalan et al. (2014) find that pay duration tends to be longer for firms with higher growth opportunities, greater long-term assets, higher R&D intensity, lower operating risk, and better past stock performance. Examining the determinants of the vesting terms of option grants, Cadman et al. (2013) arrive at similar conclusions.

However, despite widespread recognition of the importance of linking executives' pay to long-term firm performance, there is little research on the effect of pay horizon on corporate decisions. We thus focus on the voluntary disclosure of bad news. Long pay durations can motivate managers to disclose bad news for several reasons. First, they can improve the interest alignment between shareholders and managers (Gopalan et al., 2014). To the extent that a lack of disclosure of bad news is a manifestation of disclosure-related agency problems (Kothari et al., 2009; Nagar et al., 2003), longer pay durations can induce managers to be more forthcoming with bad news. Second, prior research finds that managers tend to sell the shares of their firms to diversify the risk of their portfolio when they receive additional options/shares (Ofek & Yermack, 2000). However, when the vesting period is longer, they are less likely to sell their shares given the same amount of option grants.[2] Accordingly, for managers with longer pay durations (compared to those with shorter pay durations), a decrease in stock price would lead to unrealized losses rather than realized losses in their portfolio, thus reducing

[1] Former Federal Reserve Chairman Ben Bernanke (2009) made a similar remark: "Management compensation policies should be aligned with the long-term prudential interests of the institutions . . . and [should] avoid short-term payments for transactions with long-term horizons." In addition, Goldman Sachs's Chief Executive Officer (CEO) Lloyd Blankfein (2009) urged, "An individual's performance should be evaluated over time so as to avoid excessive risk-taking. To ensure this, all equity awards need to be subject to future delivery and/or deferred exercise."

[2] Consistent with our argument, in an untabulated analysis, we find that managers' stock and option grants are significantly positively correlated with the net sales of the shares in the next year when the pay duration is short but not when the pay duration is long.

their tendency to withhold bad news. Third, Kumar et al. (2012) find that bad news disclosures can improve investment efficiency and, ultimately, the firm value in the long run. Since the welfare of managers with longer pay durations is more linked to the long-term value of their firms, they have stronger incentives to disclose bad news. Based on these discussions, we expect managers with longer pay durations to be more likely to disclose bad news than those with shorter pay durations.

Following Gopalan et al. (2014), we measure pay duration as the weighted average of the vesting periods of the four components of Chief Executive Officer (CEO) compensation, namely, salary, bonuses, restricted stock grants, and stock option grants, with the weight being the relative size of each component (with the vesting period of salaries and cash bonuses being naturally zero). The stock-based compensation measure used in prior studies implicitly assumes that restricted stock and option grants have the same vesting periods (e.g., Kothari et al., 2009; Nagar et al., 2003). In contrast, the pay duration measure explicitly incorporates the vesting schedules of different stock or option grants.

As discussed previously, pay duration is endogenously determined (e.g., Cadman et al., 2013; Gopalan et al., 2014). Some firm characteristics may affect both the pay duration and the likelihood of bad news forecasts. We address this omitted correlated variable issue in several ways. First, we control for all of the important determinants of bad news disclosure identified in the prior research. Second, we use pay duration to explain one-year-ahead bad news forecast issuance. Third, we adopt an instrumental variable approach by using the state average and the industry average of pay duration as the instruments for a firm's pay duration based on the results in Kedia and Rajgopal (2009) and Hochberg and Lindsey (2010).

Using a sample of 7536 firm-year observations from Russell 3000 firms between 2006 and 2010, we examine whether managers with longer pay durations are more likely to provide bad news earnings forecasts. We find that after controlling for the level of stock-based compensation and other determinants of pay duration and voluntary disclosure, pay duration is positively correlated with the likelihood of bad news earnings forecasts.[3] Consistent with our expectation, this result indicates that managers with longer pay durations are more forthcoming with bad news. This result holds whether we use an annual measure or a cumulative measure of pay duration and is robust to an alternative measure of pay duration (i.e., a measure based on options and stocks only, excluding cash and bonuses). We also obtain consistent results from a change analysis. The change in pay duration is positively correlated with the change in the likelihood of issuing bad news earnings forecasts. Furthermore, we find that pay duration is positively correlated with the accuracy of bad news earnings forecasts, suggesting that pay duration improves not only the quantity but also the quality of voluntary disclosures.

We then explore the circumstances under which pay duration can be more effective in motivating managers to disclose bad news. Since long pay durations motivate managers to disclose information, their marginal benefits are likely smaller when there are other mechanisms to induce managers to disclose information or when the quality of the information environment is already high. First, because prior research finds that firms with strong monitoring tend to make more disclosures (e.g., Ajinkya et al., 2005), the effect of pay duration should be stronger when the monitoring is weaker. Using board independence and institutional ownership to capture the effectiveness of shareholder monitoring, we find that pay duration has a stronger effect on firms with lower board independence and institutional ownership. Second, using analyst coverage and share turnover to capture the quality

[3] We find consistent results when we examine the frequency of bad news forecasts instead of the likelihood of forecast issuance (results untabulated).

of the information environment, we find that pay duration has a stronger effect on firms with lower analyst coverage and share turnover.

Third, prior research finds that firms facing higher litigation risk are more likely to disclose bad news (e.g., Skinner, 1994, 1997). Thus, the incremental effect of pay duration would be greater for firms facing lower litigation risk. Using an industry-based measure of litigation risk, we find that the effect of pay duration is more pronounced among firms operating in less litigious industries. Finally, prior studies suggest that the managers of firms operating in more homogenous industries have greater job security concerns (Parrino, 1997). Therefore, these managers likely have stronger incentives to withhold bad news. The effect of pay duration on bad news disclosure would then be stronger for managers in more homogenous industries. Using a measure of industry homogeneity adopted from Parrino (1997), we find consistent results.

We also conduct additional tests to provide further insights. First, since bad news disclosure is conditional upon bad news incidence, we repeat our main regression separately for the firms that are more likely to have experienced bad news and those that are less likely. We find that the positive effect of pay duration on bad news disclosures is observed only for the subsample of firms with a higher likelihood of bad news incidence. Second, to reconcile our results with those of Nagar et al. (2003), we examine the effect of pay duration on all management forecasts, including both good news and bad news forecasts. We find a positive effect of pay duration on the issuance of management forecasts in general; this result is not surprising given our main results based on bad news forecasts. In addition, consistent with Nagar et al. (2003), we find that the level of stock-based compensation has a significantly positive effect on management forecasts when we exclude pay duration, but its incremental effect is insignificant when pay duration is included in the analyses.

We make the following contributions to the literature. First, we add to the voluntary disclosure literature that links executive compensation to management forecasts. While Baginski et al. (2018) use CEOs' ex-ante severance pay agreements as a proxy for manager horizon and career concern, we focus on the managerial short-termism arising from stock-based compensation. Prior research has found that the level of stock-based compensation influences the incentive alignment between managers and shareholders in the voluntary disclosure setting (e.g., Nagar et al., 2003). We extend this line of research by examining another important and distinct feature of stock-based compensation, that is, the vesting period. Given the recent evidence that stock-based compensation can induce managers to be myopic, we shed light on this issue by providing evidence that longer pay durations can induce managers to be more forthcoming with bad news.

Second, we contribute to the literature on executive compensation by focusing on the time horizon of executive compensation, which has received little attention. Cadman et al. (2013) study the determinants of option grant vesting terms, and Gopalan et al. (2014) examine the determinants of pay duration. Our study complements these studies by examining how pay duration affects voluntary disclosure. Our evidence should be of interest to shareholders and boards of directors, given the importance of disclosures for corporate governance (e.g., Beyer et al., 2010). Note that although we find an important benefit of lengthening pay duration (i.e., incentivizing managers to disclose bad news in a timely fashion), we do not consider the corresponding costs, and thus our analyses do not imply that longer pay durations should be adopted by all firms.

2 BACKGROUND AND HYPOTHESIS DEVELOPMENT

2.1 Research on stock-based compensation and voluntary disclosure

Through involvement in their firms' operations, managers enjoy an information advantage over shareholders with respect to firm profitability. Disclosures can reduce the information asymmetry between managers and shareholders, thereby increasing stock liquidity, decreasing the cost of capital, and enhancing firm value. Disclosures also enable shareholders to better monitor managers, again leading to an increase in firm value.[4] Moreover, timely disclosures of bad news can reduce litigation risk (Field et al., 2005; Skinner, 1994, 1997). In a typical class-action lawsuit, plaintiffs sue managers when they believe that managers' failure to promptly disclose adverse information causes large losses due to significant equity price drops.

While disclosures can benefit shareholders, they are costly to managers. Disclosures decrease managers' information advantage and can potentially reduce insider trading profits (Baiman & Verrecchia, 1996). As disclosures can enhance investors' monitoring, they can also reduce managers' consumption of perks and firm control. As a result, managers prefer to make fewer disclosures, particularly those of bad news, because shareholders may act on this type of information (Shleifer & Vishny, 1989). In addition, as disclosures can help the labor market better assess the talent and capabilities of managers, managers are reluctant to disclose if they are uncertain how the market will respond to their disclosures (Nagar, 1999). The reluctance to reveal information is referred to as disclosure-related agency problems, which are known to arise when managers' interests are not aligned with those of the shareholders (Nagar et al., 2003).

Prior research suggests that stock-based compensation can improve the interest alignment between shareholders and managers, thus reducing agency problems in general (Jensen & Meckling, 1976; Morck et al., 1988) and disclosure-related agency problems in particular (Nagar et al., 2003). However, Goldman and Slezak (2006) find that stock-based compensation is a double-edged sword; it can induce managers to exert more effort to increase firm value, but it can also induce managers to engage in earnings management. In addition, while some studies, such as those of Armstrong et al. (2010) and Erickson et al. (2006), do not find a significant relation between equity incentives and accounting fraud or accounting irregularities, other studies provide evidence suggesting that stock-based compensation can motivate managers to pursue short-term gains at the expense of long-term firm value (e.g., Bergstresser & Philippon, 2006; Bolton et al., 2006; Cheng & Warfield, 2005; Efendi et al., 2007).[5,6]

Moreover, while stock-based compensation can increase the propensity that good news is disclosed, its effect on the disclosure of bad news is less clear. Stock-based compensation may elicit the disclosure of bad news if the stock market interprets nondisclosure as a worse signal (Milgrom, 1981; Nagar et al., 2003; Verrecchia, 1983). However, Kothari et al. (2009) find that managers tend to withhold bad news, especially when the managers' personal wealth is more closely tied to their firms' stock price. Their evidence suggests that stock-based compensation may actually dampen the issuance of bad news disclosures. Moreover, the results of Kothari et al. (2009) are consistent with recent

[4] For example, see Diamond and Verrecchia (1991) and Glosten and Milgrom (1985) for the effects of corporate disclosure on the information asymmetry between managers and shareholders and Bushman and Smith (2001) and Shleifer and Vishny (1989) for the effects on agency costs.

[5] For example, Cheng and Warfield (2005) and Bergstresser and Philippon (2006) find that managers with higher equity incentives are more likely to manage earnings. Burns and Kedia (2006) and Efendi et al. (2007) find that the likelihood of accounting restatements is positively related to managers' in-the-money option holdings. These studies overall suggest that because managers who receive stock/option grants tend to sell their shares and thus benefit from higher stock prices, stock-based compensation can induce managers to inflate short-term earnings and stock prices.

[6] While the prior studies discussed so far were conducted mainly in a US setting, we acknowledge that there are country-specific differences in pay practices. For example, compared to US firms, Japanese firms likely demand a higher extent of accounting conservatism because executives' incentive-based compensation is predominantly based on earnings rather than stock returns in Japanese firms (Iwasaki et al., 2018).

evidence suggesting that managers with stock-based compensation tend to focus more on the current stock prices rather than the long-term value of the firm, and these managers may engage in value-decreasing activities in the pursuit of short-term gains.[7] In sum, previous studies provide inconclusive evidence of the effect of equity-based compensation on managers' voluntary disclosures of bad news.

As discussed previously, both researchers and practitioners suggest that the excessive focus on short-term stock prices induced by stock-based compensation can be mitigated by lengthening the vesting period of stock-based compensation. When the vesting period is longer, managers care more about the long-term firm value and less about short-term stock prices. Consistent with this notion, Gopalan et al. (2014) find a negative relation between managers' pay durations and abnormal accruals (their proxy for managers' myopic behavior). This result suggests that longer pay durations improve the incentive alignment between shareholders and managers. It thus follows that given the same level of stock-based compensation, the effect of stock-based compensation may vary with its duration. We, therefore, examine whether long pay durations can mitigate disclosure-related agency problems and improve the voluntary disclosure of bad news.

2.2 Hypothesis development

We develop our hypotheses by discussing how the costs and benefits of voluntary disclosure vary with pay duration. While some costs and benefits, such as increased liquidity, lower cost of capital, and managers' better career outcomes (e.g., reputation and employment opportunities), may affect both short-term and long-term focused managers, others may vary with the managers' horizon. In particular, if managers with long pay durations enjoy greater benefits from enhanced disclosures and/or if disclosures are less costly for them, they would be more forthcoming than managers with short pay durations. In the following, we discuss why managers with long pay durations are more likely to disclose bad news than those with short pay durations.

First, as discussed previously, Gopalan et al. (2014) argue that longer pay durations can reduce agency problems, as managers with longer pay durations focus on long-term performance and firm value, leading to a better interest alignment between managers and shareholders. It thus follows that longer pay durations can reduce disclosure-related agency problems and managers with long pay durations are more likely to disclose bad news than those with short pay durations.

Second, due to the longer vesting period of option/stock grants, managers with long pay durations are less likely to exercise their options and sell their shares in the short term. Prior studies find that to diversify the risk of their portfolio, managers tend to sell the shares of their firms when they receive additional stock-based compensation (Cheng & Warfield, 2005; Ofek & Yermack, 2000). However, when the vesting period is longer, they are less likely to sell their shares given the same amount of option grants (Ofek & Yermack, 2000). Accordingly, for managers with longer pay durations (compared to managers with shorter pay durations), a decrease in stock price would lead to unrealized losses rather than realized losses in their portfolio, thus reducing their tendency to withhold bad news.[8] As a

[7] Prior studies find that equity-based compensation may lead to opportunistic disclosures in certain circumstances. For example, Aboody and Kasznik (2000) find that managers delay good news disclosures and accelerate bad news disclosures before the award date of stock options. They interpret this disclosure behavior as opportunistic since it can decrease the stock price on the option grant date and the exercise price for stock options, thus increasing the value of the options awards. In addition, Cheng and Lo (2006) find that managers strategically increase the number of bad news forecasts to reduce the stock price before they purchase shares of their own companies.

[8] In an untabulated analysis, we corroborate that managers' stock and option grants are positively correlated with the net sales of the shares in the next year when the pay duration is short but not when the pay duration is

result, managers with long pay durations have weaker incentives to withhold bad news than those with short pay durations.

Finally, Kumar et al. (2012) find that bad news disclosures can improve investment efficiency and, ultimately, firm value in the long run. In their model, managers' disclosures, in general, can reduce the divergence between investors' beliefs and managers' private information on firm prospects, helping investors make better capital allocation decisions. In particular, they argue that managers' disclosures of bad news can improve investment efficiency via more efficient resource allocation, although they may trigger a short-term decrease in stock price. Kumar et al. (2012) also find that relative to managers with short horizons, those with long-term stakes in their firms have a greater propensity to disclose bad news to improve investment efficiency because they are able to enjoy the long-term benefits arising from the enhanced efficiency.[9] As a result, we expect managers with long pay durations to have greater incentives to provide more timely disclosures of bad news.[10]

Note that we use pay duration as a proxy for manager horizon because we want to capture manager horizon arising from compensation contracts. Our focus on pay duration is particularly important given the conflicting viewpoints on the effect of stock-based compensation on agency problems related to financial reporting and disclosure. On the one hand, stock-based compensation is instrumental in mitigating agency problems by improving the incentive alignments between shareholders and managers (e.g., Nagar et al., 2003). On the other hand, some researchers suggest that stock-based compensation can lead to financial misreporting (e.g., Bergstresser & Philippon, 2006; Cheng & Warfield, 2005; Efendi et al., 2007). By using pay duration as an empirical proxy for manager horizon, we aim to contribute to this debate.

We use management earnings forecasts to capture bad news disclosures. Prior studies have found that earnings forecasts are important channels through which managers distribute their private information (e.g., Healy & Palepu, 2001). For example, Beyer et al. (2010) report that approximately 16% of the variance in quarterly returns is explained by earnings guidance, whereas only 4% is explained by Securities and Exchange Commission (SEC) filings and press releases combined. In addition, management forecasts are important voluntary disclosures and the effect of pay duration on voluntary disclosure is probably bigger than its effect on mandatory disclosure, increasing the power of the tests. Thus, our first hypothesis (in the alternative form) is as follows:

H1: Ceteris paribus, managers with long pay durations are more likely to issue bad news forecasts than managers with short pay durations.

However, we may not find results consistent with H1. One may argue that managers wait for the economic situation to recover instead of releasing bad news promptly as suggested by the survey evidence in Graham et al. (2005). Moreover, they may withhold bad news to save their reputation if

long. However, we acknowledge that withholding bad news before insider sales is subject to litigation risk (Cheng & Lo, 2006). Nonetheless, we reason that managers are more likely to engage in this type of behavior when the potential benefits of this strategy are higher. To the extent that these benefits are higher for managers with short pay durations, as they are more likely to sell shares in the near future than those with long pay durations, we expect them to be more likely to withhold bad news than those with long pay durations.

[9] Kumar et al. (2012) argue that although disclosures of bad news entail short-term stock price drops, for managers with long-term stakes in their firms, the long-term gains from the enhanced firm value (as a result of improved efficiency in investment) outweigh the costs of the short-term stock price drops. However, it is not the case for managers with short-term stakes, as the effect of short-term price drops is likely to dominate.

[10] If managers with short pay durations were more likely to engage in myopic investments (Gopalan et al. 2014), they would disclose less so that they could limit shareholders' ability to monitor them (e.g., Edlin & Stigliz, 1995).

they believe that they can fix the problem later. If this were the case, pay duration would not be positively associated with managers' disclosures of bad news.

Our hypotheses on the cross-sectional variation relate to the circumstances under which pay duration is likely to be more effective in motivating managers to disclose bad news. First, prior research finds that firms with better governance are more effective in addressing agency problems, as they demand more information from their managers. Specifically, prior research finds that firms with more independent boards and firms with higher institutional ownership are more likely to disclose (e.g., Ajinkya et al., 2005). Therefore, the marginal effect of pay duration is likely to be smaller for firms with better governance. In contrast, for firms with poor governance, the effect of pay duration is expected to be more pronounced.

Second, when the information environment of a firm is already rich, further enhancing disclosure arguably has a smaller marginal effect (e.g., Verrecchia, 1990).[11] In contrast, for firms with poor information environments, the benefits of enhancing disclosure are greater, and therefore, pay duration would have a stronger effect on bad news disclosures.

Third, as withholding bad news can increase litigation risk, prior studies find that firms are more likely to provide bad news when they face higher litigation risk (e.g., Skinner, 1994, 1997). Since these firms are motivated to disclose bad news in a timely fashion, the incremental effect of pay duration is expected to be weaker. In contrast, for firms facing lower litigation risk, the effect of pay duration is expected to be stronger in inducing bad news disclosures.[12]

Finally, Parrino (1997) suggests that because it is easier for firms in more homogeneous industries to find CEO candidates (i.e., executives working in the same industry and having similar experience and skills), they are more likely to replace CEOs. As a result, CEOs in more homogenous industries have greater job security concerns than their counterparts in other industries. Since disclosing bad news can exacerbate career concerns, managers in more homogeneous industries are less likely to disclose bad news. As a result, the effect of pay duration in motivating firms to disclose bad news would be stronger for managers in more homogeneous industries.

These discussions lead to the following hypotheses (stated in the alternative form):

The effect of pay duration on bad news disclosures, as hypothesized in H1, is stronger for

H2: Firms with weaker governance,

H3: Firms with poorer information environments,

H4: Firms facing lower litigation risk, and

H5: Firms operating in more homogenous industries.

[11] As in many prior studies, we take the quality of the existing information environment as a given and consider the incremental effect of additional disclosures.

[12] However, if firms facing lower litigation risk tend to have weaker incentives to disclose bad news, an increase in pay duration may not have any meaningful effect on these firms' disclosure behavior. Then, we may not find results consistent with our expectation.

3 RESEARCH DESIGN

3.1 Data and sample selection

We obtain the required data from various sources. We obtain executive compensation data from Equilar, which provides detailed information on executive compensation from 2006 onward for firms included in the Russell 3000 index. The data coverage in Equilar is comprehensive and includes the vesting schedule of individual stock and option grants, which is not available from ExecuComp.[13] We collect the data on management forecasts from First Call's Company Issued Guidance file. For the control variables, we obtain financial information data from Compustat, stock price/return data from the Center for Research in Security Prices (CRSP), analyst forecast data from the Institutional Broker Estimate System (I/B/E/S), institutional ownership data from the Thomson Reuters Institutional Holdings (13f), equity offerings data from the Security Data Corporation's Global New Issues database, and boards of directors data from the corporate library.

Table 1 describes our sample selection process. As we analyze how the duration of managers' compensation awarded in year t influences the disclosure of earnings forecasts in year t+1, we require the CEO in year t+1 to have compensation data in year t.[14] This procedure results in 10,920 firm-year observations in Equilar for the five-year period from 2006 to 2010. Our sample period ends with 2010 because our management forecast data obtained from First Call stopped in November 2011.[15] As our research design requires a one-year lag for pay duration, our analyses focus on management earnings forecasts issued during the period beginning with 2007. Of these observations, 150 firm-years are excluded because we are unable to find information on actual earnings or earnings announcement dates from First Call. In addition, 3234 firm-years are excluded due to missing values for the control variables. This procedure leaves us with a sample of 7536 firm-year observations.

[13] To illustrate the advantage of using Equilar, consider a CEO receiving stock awards of $100 each in March, June, and September with vesting periods of one, two, and three years, respectively. Assume also that these awards are the only equity-based compensation awarded to the CEO along with $500 of cash compensation in 2019. Then the CEO's annual pay duration in 2019 is calculated as ($100×1 + $100×2 + $100×3)/($300 + $500) = 0.75. Although ExecuComp provides data on the grant-date fair value of option and stock awards at the individual grant level in the Plan-based Awards table, it does not provide data on the vesting schedules of individual grants. However, Equilar provides all the information necessary to calculate pay duration – grant-date fair value and vesting period at the individual grant level.

[14] We include the observations in which the CEO in year t+1 is not the CEO in year t in the analyses as long as the executive works in the same firm (e.g., as Chief Financial Officer (CFO)).

[15] We include observations from the 2010 fiscal year and the corresponding management forecast data in 2011 to increase the sample size and the power of the test. However, including these observations introduces two complications. First, for 2011, we cannot obtain actual Earnings Per Share (EPS) or analyst consensus forecasts from the First Call database. As a result, we obtain these data from the I/B/E/S. Second, the management forecast coverage for 2011 is incomplete. Although these complications are likely to introduce noise into the analyses, they should not bias our results. Our inference remains the same when we restrict our sample period from 2006 to 2009 (results untabulated).

TABLE 1. Sample selection

Criteria	**Number of observations**
Number of firm-years in Equilar in the 2006 to 2010 period	10,920
Minus	
Number of firm-years without earnings data on the actual files from First Call	(150)
Number of firm-years without data from the Compustat, CRSP, I/B/E/S, Thomson Reuters institutional holdings (13f), corporate library, or Security Data Corporation databases	(3234)
Final sample	7536

This table reports the sample selection process.

3.2 Measurement of pay duration

Pay duration captures the time horizon of managers' incentives arising from a mix of short-term and long-term CEO compensation. Following Gopalan et al. (2014), we measure pay duration (*P_DURATION*) as the weighted average of the vesting periods of the four CEO compensation components in a given year, namely, salary, bonuses, restricted stock grants, and stock option grants, with the weight being the relative size of each compensation component. Specifically, pay duration is calculated as follows:

$$P\_DURATION = \frac{\sum_{i=1}^{n_1} Restricted\ Stock_i \times t_i + \sum_{j=1}^{n_2} Option_j \times t_j}{Salary + Bonus + \sum_{i=1}^{n_1} Restricted\ Stock_i + \sum_{j=1}^{n_2} Option_j},$$

where Salary is the dollar value of annual salary, Bonus is the dollar value of annual bonuses, Restricted Stocki is the grantdate fair value of restricted stock grant i with a vesting period of ti (measured in the number of years), Optionj is the grant date fair value of stock option grant j with a vesting period of tj (measured in the number of years), and n1 (n2) is the total number of stock (option) grants in a given year.[16] See Appendix A for an example of the calculation of pay duration. Note that although the vesting period is zero for salary and bonuses, it is important to include them in the denominator. Pay duration is constructed to capture managers' horizons induced by their annual compensation. If managers' compensation is primarily in the form of salary and bonuses, granting them a small number of options and stocks with a very long vesting period would not induce them to act in the interests of long-term shareholders.[17]

[16] When the grants of restricted stock and stock option have a graded vesting schedule, the vesting period t is modified to (t+1)/2.

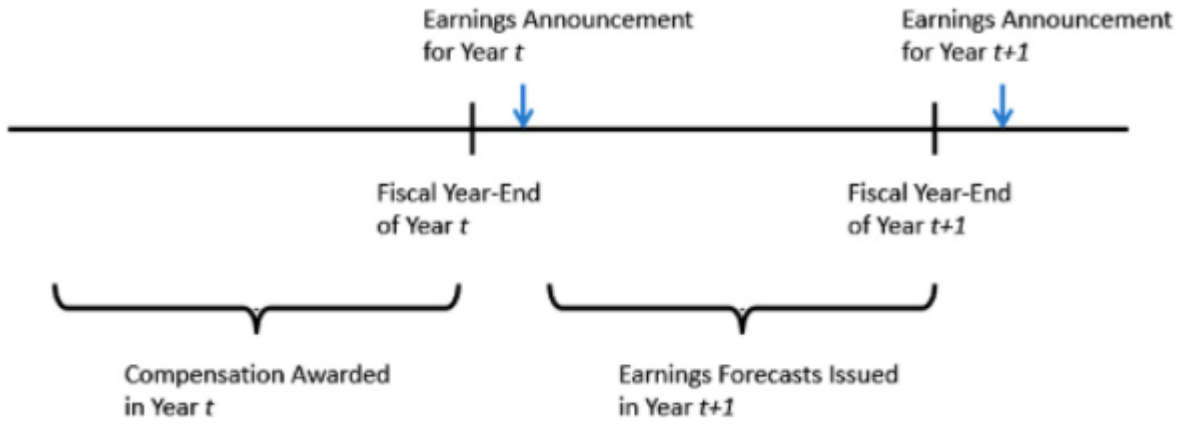
[17] One complication with the calculation of P_DURATION is that the number of securities and their vesting schedules are sometimes contingent on future performance. For these securities, we follow Gopalan et al. (2014) and make the following assumptions. First, when the vesting of a grant is contingent upon future performance but the number of securities is fixed, we assume that this grant will vest all at once at the end of the period over which performance is measured. Second, when a grant has a performance-based vesting schedule, we assume that this grant will vest according to the initially specified vesting schedule. Third, when a

This annual-based measure, however, has two limitations. First, it assumes that managers exercise all of the grants once they vest. However, some managers may hold the options and stocks for an extended period after they vest. Thus, the actual horizon of CEO compensation is longer than what is indicated by the pay duration measure. However, there is no compelling reason to believe that this issue would introduce a systematic bias. Second, the measure does not incorporate the effects of existing stock and option holdings or deferred compensation, such as postretirement benefits, for which the vesting schedules are usually unavailable. Our measure therefore only reflects the incentives arising from the current year's compensation. As a sensitivity test, we calculate a cumulative measure of pay duration by including the stocks and options awarded in previous years. While the inferences based on this alternative measure remain the same, this measurement also has its own limitations; its calculation requires many additional assumptions (due to a lack of vesting data before 2006) that are likely to lead to measurement errors. Nonetheless, obtaining similar results from both measures increases our confidence in the results. Section 4.2 provides a detailed discussion.[18]

3.3 Management earnings forecasts

Figure 1 depicts the timeline of the variable measurement. We focus on managers' forecasts of the current period's earnings, either annual or quarterly, issued after the earnings announcement for fiscal year t but before the end of fiscal year t+1. We exclude the earnings forecasts issued between the fiscal period-end and the earnings announcement dates (i.e., pre-announcements) because managers have less discretion in these forecasts.[19]

Figure 1: Timeline of compensation awards and earnings forecasts



grant is part of a long-term incentive plan in which the exact number of securities offered is contingent on future performance, we assume that the number of securities offered is the target number of securities and that the vesting begins after the end of the performance period. For example, if a manager's contract specifies that he or she will receive an option with a vesting period of three years conditional on his or her performance over the next two years, the manager is assumed to receive an option with a vesting period of five years (i.e., the performance period plus the contractual vesting period).

[18] While the fair value of stock option on its grant date is used to calculate the annual measure of pay duration, the option values are recalculated using the Black–Scholes option pricing formula at the end of each year to calculate the cumulative measure of pay duration. Thus, underwater options can cause measurement errors for both measures of pay duration if firms experience a substantial decline in stock price below the strike price during the year. However, option expiration does not lead to measurement errors since expired options are not considered in constructing the annual and cumulative measures of pay duration.

[19] We follow previous studies (e.g., Ajinkya et al., 2005; Houston et al., 2010) and exclude pre-announcements as they are motivated by upcoming earnings announcements. Our inferences remain the same if we include pre-announcements in the measurement of forecast issuance (results untabulated).

Prior studies classify a forecast as bad news if the forecast is lower than the most recent consensus analyst forecast (e.g., Anilowski et al., 2007; Cheng et al., 2013). However, when managers' forecasts are released contemporaneously with earnings announcements, analysts' prevailing consensus is no longer a good proxy for the market's up-to-date expectation of future earnings. We thus adopt Rogers and Van Buskirk's (2013) procedure to calculate the conditional analyst expectations, which reflect the hypothetical estimates that analysts would have issued immediately following the earnings announcement but without the effect of management forecasts. We then classify a forecast as bad news if the forecast is lower than the conditional analyst expectation. We define an indicator variable, D_MF, which equals 1 for the firms that issue bad news earnings forecasts at least once in a given year and 0 otherwise.[20]

3.4 Control variables

We control for a series of variables known to affect voluntary disclosures as suggested by prior research. First, we include managers' stock-based compensation (EQ_COMP) and share ownership (SHAREH_OWN). Nagar et al. (2003) find that the former (latter) is positively (negatively) associated with managers' forecast issuance. Second, we control for the frequency of option grants in each year (OPTION_GRANT). Aboody and Kasznik (2000) find that managers tend to accelerate bad news just before option grant dates to lower the exercise price of the options. Third, we include corporate governance variables, such as institutional ownership (INST) and board independence (BIND). Ajinkya et al. (2005) and Karamanou and Vefeas (2005) find that corporate governance is positively related to the issuance of management forecasts. Fourth, following prior studies (e.g., Ajinkya & Gift, 1984; Frankel et al., 1995; Hutton, 2005; Lang & Lundholm, 1993), we control for analyst following (AC), analyst forecast dispersion (DISP), return volatility (RVOL), litigation (LIT), firm size (SIZE), market-to-book (MTB), equity issuance (EQ_ISS), stock performance (RET), and change in operating performance (CHG_ROA).[21] Note that we control for both RET and CHG_ROA, the proxies for firm news; firms must have bad news to issue bad news forecasts. Finally, we include industry- and year-fixed effects to control for the potential variation in disclosure activities over time and across industries. The measurement of these variables is explained in more detail in Appendix B.

3.5 Descriptive statistics

Panel A of Table 2 reports the descriptive statistics of the variables used in our analyses. The mean of D_MF is 0.3511, suggesting that 35% of the firm-years in our sample provide bad news earnings forecasts at least once per year. The mean of P_DURATION is 1.4700, suggesting that managers' total compensation in our sample vests in approximately 1.5 years on average. This number may seem small, but note that we include both salary and bonus, which vest immediately, in the denominator. More importantly, we observe a large variation in pay duration: the average pay duration is 0.2093 for the bottom 25% of the sample and 2.5412 for the top 25% of the sample (not tabulated). The mean of EQ_COMP is 0.3912, implying that 39% of annual compensation is in the form of options and stocks. The mean of SHARE_OWN is 0.0362, indicating that a CEO in our sample owns 3.62% of the firm's shares on average. The mean of OPTION_GRANT is 0.6405, indicating that an average CEO is granted options approximately every other year. In addition, our sample firms have institutional ownership of

[20] Our results are similar when we do not make adjustments for bundled forecasts (results untabulated).
[21] In the main analyses, LIT is measured as an indicator variable for highly litigious industries. In an untabulated analysis, we use an alternative measure developed by Kim and Skinner (2012) and our inferences remain the same.

75% and nine analysts following, and 75% of the firms have board independence of 60% or higher on average. The distributions of these and other firm characteristics in our sample are similar to those in recent studies on management forecasts (e.g., Chen et al., 2008; Feng et al., 2009).

Panel B reports the Pearson correlation coefficients among the variables. Consistent with H1, P_DURATION is positively correlated with D_MF. Not surprisingly, P_DURATION is highly correlated with EQ_COMP (correlation coefficient = 0.71), implying that when both P_DURATION and EQ_COMP are included in the regressions, the coefficient on P_DURATION only captures the incremental effect of pay duration over the level of stock-based compensation.[22] The correlation coefficients among the control variables are relatively small, except that for analyst coverage and firm size (0.47).

TABLE 2. Descriptive statistics

Panel A: Descriptive statistics of management forecasts and firm characteristics

Variable	N	Mean	SD	Q1	Median	Q3
D_MF	7,536	0.3511	0.4774	0.0000	0.0000	1.0000
P_DURATION	7,536	1.4700	0.9112	0.8357	1.6000	2.0682
EQ_COMP	7,536	0.3912	0.2685	0.2003	0.3888	0.5810
SHARE_OWN	7,536	0.0362	0.0778	0.0044	0.0113	0.0283
OPTION_GRANT	7,536	0.6405	0.7802	0.0000	1.0000	1.0000
INST	7,536	0.7474	0.2199	0.6389	0.7949	0.9140
AC	7,536	9.4179	6.4455	4.0000	8.0000	13.0000
DISP	7,536	0.0725	0.1878	0.0101	0.0208	0.0517
RVOL	7,536	3.1342	1.4760	2.0790	2.7965	3.8088
BIND	7,536	0.7549	0.4302	1.0000	1.0000	1.0000
LIT	7,536	0.2877	0.4527	0.0000	0.0000	1.0000
SIZE (in millions)*	7,536	9,252	23,507	624	1,990	6,266
MTB	7,536	2.9901	3.1646	1.3386	2.0342	3.3202
EQ_ISS	7,536	0.0882	0.2837	0.0000	0.0000	0.0000
RET	7,536	0.0390	0.4069	−0.2104	−0.0135	0.2053
CHG_ROA	7,536	−0.0034	0.0943	−0.0215	−0.0003	0.0182

Panel B: Pearson correlation coefficients

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1)	D_MF															
(2)	P_DURATION	**0.14**														
(3)	EQ_COMP	**0.09**	**0.71**													
(4)	SHARE_OWN	**−0.07**	**−0.23**													
(5)	OPTION_GRANT	**0.07**	**0.12**	**0.13**	**−0.09**											
(6)	INST	**0.17**	**0.20**	**0.22**	**−0.17**	**0.07**										
(7)	AC	**0.14**	**0.28**	**0.24**	**−0.10**	**0.13**	**0.15**									
(8)	DISP	**−0.15**	**−0.07**	−0.01	**0.03**	−0.02	**−0.08**	**−0.11**								
(9)	RVOL	**−0.14**	**−0.11**	0.01	**0.07**	0.01	**−0.07**	**−0.19**	**0.18**							
(10)	BIND	**0.09**	**0.15**	**0.10**	**−0.18**	**0.06**	**0.15**	**0.07**	**−0.02**	0.00						
(11)	LIT	**0.10**	**0.04**	**0.12**	**0.05**	**0.07**	**0.07**	**0.17**	−0.02	0.02	**−0.01**					
(12)	SIZE	**0.04**	**0.27**	**0.12**	**−0.19**	**0.06**	**−0.03**	**0.47**	**−0.06**	**−0.21**	0.13	**−0.22**				
(13)	MTB	0.01	**0.07**	**0.06**	**0.03**	**0.08**	**0.03**	**0.15**	**−0.06**	**−0.04**	−0.01	**0.16**	**−0.16**			
(14)	EQ_ISS	**−0.12**	−0.01	0.00	−0.02	**−0.03**	**−0.09**	**−0.08**	**0.07**	**0.15**	**−0.03**	**−0.07**	**0.03**	−0.01		
(15)	RET	0.00	0.00	**0.02**	0.02	**0.03**	0.01	−0.02	**0.03**	**0.04**	−0.01	**0.06**	**−0.06**	**−0.02**	**0.05**	
(16)	CHG_ROA	**−0.04**	0.00	0.00	−0.02	0.00	−0.02	−0.01	**0.05**	**−0.10**	0.00	0.01	−0.01	**0.06**	0.01	**0.24**

Notes: This table reports the descriptive statistics of the variables used in our analyses. Appendix B provides the variable definitions. All of the continuous variables are winsorized at the 1% and 99% levels. The correlation coefficients significant at the 5% level or lower are in boldface.

*We use the natural logarithm of this variable in the correlation table and regression analyses.

[22] The high correlation between P_DURATION and EQ_COMP may cause a multicollinearity problem. In an untabulated analysis, we find that our inferences remain the same when we exclude EQ_COMP from the regression model.

4 EMPIRICAL RESULTS

4.1 Determinants of pay duration

To the extent that some unobservable firm characteristics affect both pay duration and bad news disclosure, our analysis can be subject to an omitted correlated variable bias. To mitigate this concern, we conduct a two-stage instrumental variable analysis. In the first stage, we examine the determinants of pay duration, with the right-hand-side variables including a set of determinants of pay duration introduced in the prior research along with control variables used in the second-stage regression.[23] In the second-stage analysis, we use the predicted value of pay duration estimated from the first stage to explain bad news disclosure.

Cadman et al. (2013) and Gopalan et al. (2014) find that pay duration and option grant vesting terms are endogenously determined. For example, both studies argue that firms with high growth potential tend to invest in long-term projects. Thus, they are more likely to offer CEOs longer-duration pay contracts, aligning their investment horizon with CEOs' incentive horizon. Using the market-to-book ratio (MTB) as the proxy for growth and long-term investment opportunities, the two studies find consistent evidence. On the cost side, the two studies argue that managers tend to demand a higher risk premium for longer pay duration, and this cost likely increases with the risk of the firm. Thus, riskier firms tend to offer shorter pay duration. Using return volatility (RVOL) as a proxy for firm risk, they find consistent results.

In addition, Cadman et al. (2013) and Gopalan et al. (2014) find a positive association between pay duration and stock performance (RET), suggesting that firms are likely to offer longer-duration pay contracts to retain executives with a strong performance. Longer durations can increase the cost of voluntary departure to executives, as they typically lose unvested stock and option grants upon leaving the firm. Furthermore, Gopalan et al. (2014) find that pay duration is negatively associated with nonexecutive director ownership and the extent of takeover threat but positively associated with board independence (BIND). That is, the evidence of the association between pay duration and other governance mechanisms is mixed.[24] Finally, Cadman et al. (2013) find that the vesting period of option grants is negatively correlated with CEO ownership (SHARE_OWN).

Our instruments for pay duration are state average pay duration (STATE_P_DURATION) and industry average pay duration (IND_P_DURATION). Previous studies suggest that a firm's compensation design can be affected by industry practices and/or by geographical areas in which the firm's headquarter is located. In particular, a corporate practice in the same geographical area affects an individual firm through the competition in the local labor market or the influence of fixed-agent peers (Hochberg & Lindsey, 2010). Kedia and Rajgopal (2009) find empirical evidence corroborating this idea with respect to option grants. Therefore, we expect contemporaneous STATE_P_DURATION and IND_P_DURATION to be significantly correlated with a firm's pay duration in year t, but there is no good reason to believe that they have a direct effect on a specific firm's future disclosure (i.e., the disclosure of bad news in year t+1).[25]

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[23] The primary objective of the analysis is to control for the endogeneity of pay duration and not to replicate prior research. The results are qualitatively similar when we replicate the analyses in Gopalan et al. (2014). Note that our sample differs from that of Gopalan et al. (2014) in terms of the sample period and coverage.

[24] The negative (positive) association implies that pay duration is a substitute (complement) of corporate governance under the implicit assumption that ceteris paribus, longer pay durations are preferable for shareholders.

[25] We obtain the same inferences if we exclude firms in the same industry when calculating the state average pay duration or exclude firms from the same state when calculating the industry average pay duration.

Based on these discussions, we use the following model for the first-stage regression:

$$\begin{aligned} P\_DURATION_{i,t} = {} & \beta_0 + \beta_1 EQ\_COMP_{i,t} + \beta_2 SHARE\_OWN_{i,t} + \beta_3 OPTION\_GRANT_{i,t+1} + \beta_4 INST_{i,t} \\ & + \beta_5 AC_{i,t} + \beta_6 DISP_{i,t} + \beta_7 RVOL_{i,t+1} + \beta_8 BIND_{i,t} + \beta_9 LIT_{i,t} + \beta_{10} SIZE_{i,t} \\ & + \beta_{11} MTB_{i,t} + \beta_{12} EQ\_ISS_{i,t} + \beta_{13} RET_{i,t+1} + \beta_{14} CHG\_ROA_{i,t+1} \\ & + \beta_{15} STATE\_P\_DURATION_{i,t} + \beta_{16} IND\_P\_DURATION_{i,t} + Industry\ Indicators \\ & + Year\ Indicators + \varsigma_{i,t} \end{aligned} \quad (1)$$

Table 3 reports the regression results.[26] All of the p-values are based on standard errors adjusted for firm- and year-clustering to address the potential correlation across observations (within the same firm and within the same year).[27] In column 1, when the instrumental variables are not included, we find that the coefficients on BIND, SIZE, and MTB are significantly positive, consistent with Cadman et al. (2013) and Gopalan et al. (2014). Moreover, we observe that pay duration is positively correlated with EQ_COMP and is negatively correlated with SHARE_OWN.

When we add instrumental variables in column 2, we find that both of our instruments are significantly correlated with pay duration as expected: The coefficients on STATE_P_DURATION and IND_P_DURATION are significantly positive ($p < 0.001$ in both cases). We conduct the diagnostic tests as suggested by Larcker and Rusticus (2010) and find that these instruments are powerful. The F-test for the joint explanatory power of the instruments is 435.42, which is above the suggested value of 11.59 for two instruments.

[26] Unlike Cadman et al. (2013) and Gopalan et al. (2014), we measure OPTION_GRANT, RVOL, RET, and CHG_ROA in the year of management forecast (i.e., one year ahead of pay duration measurement, year t+1), as they are used as control variables in the second stage, where the dependent variable is management forecast. Our inferences remain the same when we use the values of those variables measured in year t in Equation (1).

[27] We use year-robust standard errors together with year-fixed effects because using cluster-specific fixed effects does not completely control for the within cluster correlation of the error terms (Cameron & Miller, 2015). In addition, following Cameron and Miller (2015), we make further adjustment in calculating year-robust standard errors.

TABLE 3. Determinants of pay duration

	(1)		(2)	
	Coefficient	*p*-value	Coefficient	*p*-value
EQ_COMP	2.2203***	0.000	2.1704***	0.000
SHARE_OWN	–0.6199***	0.000	–0.5976***	0.000
OPTION_GRANT	0.0191	0.400	0.0192	0.396
INST	0.0562	0.478	0.0586	0.442
AC	0.0040	0.208	0.0043	0.167
DISP	–0.1758***	0.000	–0.1699***	0.000
RVOL	–0.0250*	0.087	–0.0264*	0.080
BIND	0.0886***	0.000	0.0910***	0.000
LIT	–0.1214***	0.001	–0.1197***	0.001
SIZE	0.0938***	0.000	0.0915***	0.000
MTB	0.0115***	0.000	0.0111***	0.000
EQ_ISS	0.0365	0.338	0.0356	0.317
RET	–0.0103	0.592	–0.0077	0.713
CHG_ROA	–0.0478	0.222	–0.0648*	0.065
STAGE_P_DUARTION			0.3244***	0.000
IND_P_DURATION			0.4915***	0.000
Industry indicators	Included		Included	
Year indicators	Included		Included	
N	7,536		7,536	
Adjusted R^2	0.5696		0.5782	
Joint *F*-test for *STATE_P_DURATION* and *IND_P_DURATION*	435.42	0.000		

Notes: This table reports the results of the ordinary least squares (OLS) regression of P_DURATION. Columns 1 and 2 present the results without and with the two instrumental variables, respectively. The two instrumental variables are the state average pay duration (STATE_P_DURATION) and the industry average pay duration (IND_P_DURATION). Appendix B provides the variable definitions. All of the continuous variables are winsorized at the 1% and 99% levels. All of the p-values are two-sided and are calculated based on standard errors adjusted for firm- and year-clustering. Since the regression includes year-fixed effects, year-clustering standard errors are further adjusted following Cameron and Miller (2015).

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

4.2 Pay duration and management forecasts: Test of H1

We use the following regression to test H1:

$$\begin{aligned} D\_MF_{i,t+1} = {} & \alpha_0 + \alpha_1 P\_DURATION_{i,t} + \alpha_2 EQ\_COMP_{i,t} + \alpha_3 SHARE\_OWN_{i,t} \\ & + \alpha_4 OPTION\_GRANT_{i,t+1} + \alpha_5 INST_{i,t} + \alpha_6 AC_{i,t} + \alpha_7 DISP_{i,t} + \alpha_8 RVOL_{i,t+1} \\ & + \alpha_9 BIND_{i,t} + \alpha_{10} LIT_{i,t} + \alpha_{11} SIZE_{i,t} + \alpha_{12} MTB_{i,t} + \alpha_{13} EQ\_ISS_{i,t+1} + \alpha_{14} RET_{i,t+1} \\ & + \alpha_{15} CHG\_ROA_{i,t+1} + Industry\ Indicators + Year\ Indicators + \varepsilon_{i,t+1} \end{aligned} \quad (2)$$

Since D_MF is a binary variable, we use the probit model to estimate this equation.[28]

[28] Our inferences remain the same when we estimate this equation using a linear probability model. Again, all of the p-values are based on standard errors adjusted for firm- and year-clustering. Since the regression includes year-fixed effects, we make further adjustment for year-clustering (Cameron & Miller, 2015). We make this adjustment in all our subsequent analyses that include year-fixed effects.

Table 4 presents the regression results. The p-values are one-sided for the coefficient on P_DURATION and two-sided otherwise. In column 1, P_DURATION is the predicted value of pay duration obtained from the first-stage regression as reported in Table 3. We find that the coefficient on P_DURATION is significantly positive (one-sided p = 0.001), suggesting that CEOs with longer pay durations are more likely to issue bad news earnings forecasts. The marginal effect is 9.7% when pay duration increases from the first to the third quartile of the sample distribution while holding other variables at their respective means. This effect is economically significant since only 35% of the firm-years have bad news forecasts. None of the other variables have a marginal effect greater in magnitude than that of P_DURATION.[29]

TABLE 4. Pay duration and bad news management forecasts

	(1) Annual *P_DURATION*			(2) Cumulative *P_DURATION*		
	Coefficient	*p*-value	Marginal effect	Coefficient	*p*-value	Marginal effect
P_DURATION (H1: +)	0.2743***	0.001	0.097	0.2215**	0.031	0.063
EQ_COMP	−0.4759***	0.007	−0.063	−0.2612	0.252	−0.035
SHARE_OWN	−0.5993**	0.036	−0.005	−0.5987**	0.038	−0.005
OPTION_GRANT	0.0604***	0.006	0.021	0.0648***	0.003	0.023
INST	0.6123***	0.000	0.059	0.6110***	0.000	0.059
AC	0.0116**	0.019	0.036	0.0119**	0.013	0.037
DISP	−1.0041***	0.000	−0.015	−1.0354***	0.000	−0.015
RVOL	−0.0807***	0.001	−0.049	−0.0828***	0.001	−0.050
BIND	0.0800*	0.099	0.000	0.0922**	0.047	0.000
LIT	0.0449	0.664	0.016	0.0439	0.680	0.015
SIZE	0.0279	0.195	0.023	0.0393*	0.057	0.032
MTB	−0.0222***	0.008	−0.015	−0.0203**	0.014	−0.014
EQ_ISS	−0.1649**	0.018	0.000	−0.1698**	0.016	0.000
RET	−0.0221	0.646	−0.003	−0.0264	0.586	−0.004
CHG_ROA	−0.6059***	0.000	−0.008	−0.6208***	0.000	−0.009
Industry indicators		Included			Included	
Year indicators		Included			Included	
N		7,536			7,536	
Pseudo R^2		0.1783			0.1783	

Notes: This table reports the results of the probit regression of the likelihood of the issuance of bad news forecasts. In column 1, P_DURATION is the annual measure of pay duration, and in column 2, P_DURATION is the cumulative measure of pay duration, which incorporates the stock and option grants awarded in the current and previous years. In both columns, the pay duration variable is a predicted value estimated from the first-stage regression as reported in Table 3 (the predicted value of cumulative P_DURATION is based on a similar model). Appendix B provides the variable definitions. All of the continuous variables are winsorized at the 1% and 99% levels. The p-values are one-sided for the coefficient on P_DURATION and two-sided otherwise. The p-values are calculated based on standard errors adjusted for firm- and year-clustering. Since the regression includes year-fixed effects, year-clustering standard errors are further adjusted following Cameron and Miller (2015). The marginal effect is calculated as the change in the probability of issuing a bad news forecast when P_DURATION changes from the 1st to the 3rd quartile (or from 0 to 1 for indicator variables) and the other variables are held at the corresponding means. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

[29] Alternatively, we calculate the marginal effect for continuous variables as the change in the probability of issuing a bad news forecast when the variable of interest changes by one standard deviation while holding the other variables at their means (results untabulated). We find that P_DURATION is still one of the variables with the largest marginal effect.

As discussed in Section 3.2, the annual pay duration measure overlooks the stock and option grants awarded in the previous years. Thus, we construct a cumulative measure of pay duration that incorporates the stock and option grants awarded in the current year and those awarded in previous years. Although the cumulative measure better captures managers' incentives conceptually, it has its limitations. As Equilar provides detailed information about individual stock and option grants starting from 2006, when the new regulations on executive compensation became effective, we can only incorporate stock and option grants awarded from 2006 onwards.[30] For example, the cumulative measure for a CEO in 2008 includes options and stocks granted in 2006, 2007, and 2008 that are still held by the CEO. Note that this cumulative measure is based on more years' option and stock grants in the latter part of the sample period (i.e., 2009 and 2010) than in the earlier part of the sample period (i.e., 2007 and 2008).[31]

We re-estimate Equation (2) using the predicted value of the cumulative measure of P_DURATION and report the results in column 2. As in column 1, the predicted value is obtained by estimating Equation (1) with P_DURATION, STATE_P_DURATION and IND_P_DURATION being replaced with corresponding cumulative measures. The inferences based on the results reported in column 2 are the same. The coefficient on P_DURATION is significantly positive (one-sided p = 0.031).

The results for the control variables are largely consistent with those in previous studies (e.g., Ajinkya et al., 2005; Feng et al., 2009). We find that the likelihood of bad news forecasts is positively correlated with the frequency of option grants (OPTION_GRANTS), institutional ownership (INST), analyst coverage (AC), board independence (BIND), and firm size (SIZE) and is negatively correlated with manager ownership (SHARE_OWN), forecast dispersion (DISP), return volatility (RVOL), market-to-book ratio (MTB), equity issuance (EQ_ISS), and change in firm performance (CHG_ROA). The coefficient on litigation risk (LIT) is insignificant because it is largely embedded in the industry indicators.[32] We find that the coefficient on EQ_COMP is significantly negative in column 1 but insignificant in column 2. While this result may appear to be inconsistent with Nagar et al. (2003), Nagar et al. (2003) do not separately examine bad news forecasts and do not control for pay duration.[33] We reconcile our results with those of Nagar et al. (2003) when we examine the likelihood of all management forecasts, including both good news and bad news forecasts, in Section 5.2.

In sum, the reported results are consistent with H1, suggesting that managers with long pay durations are more likely to issue bad news forecasts.[34] These results hold for both the annual and the

[30] When constructing the cumulative measure, the values of previously awarded unvested stock and option grants are re-estimated at the end of each year. The stock values are calculated as the closing price×the number of shares and the option values are calculated using the Black–Scholes option pricing formula, which was developed by Black and Scholes (1973) and modified to account for dividend payouts by Merton (1973). For the options that are awarded as part of long-term incentive plans, Equilar does not provide the exercise price and expiration date. Therefore, for these options, we assume that their values stay the same as their grant-date present value, as provided in Equilar, throughout the vesting period. Excluding these options does not affect our inferences.

[31] In an untabulated analysis, we find that the main measure of pay duration and the cumulative measure of pay duration are highly correlated in the later years of our sample period (correlation coefficient = 0.87 in 2009 and 0.85 in 2010), suggesting that our main measure based on annual compensation is a valid proxy for the cumulative pay duration. The mean of the cumulative measure is 1.4237, which is close to 1.4700, the mean of our main measure.

[32] While the litigation variable is based on four-digit Standard Industry Classification (SIC) codes, industry indicators are based on two-digit SIC codes.

[33] The significantly negative coefficient on EQ_COMP in column 1 is consistent with Kothari et al. (2009), which is evidence that managers with higher equity based compensation are less likely to disclose bad news.

[34] Our inferences remain the same when we use the raw value instead of the predicted value of pay duration in all analyses related to H1 through H5.

cumulative measure of pay duration. To ensure that the results are robust, we present the results based on both measures of pay duration for the following tests.[35]

4.3 Robustness tests for H1

Table 5 reports the probit regression result when we alternatively measure pay duration as the weighted average of the vesting periods of equity-based compensation (i.e., excluding salary and bonus in the measure's denominator).[36] The coefficient on P_DURATION is significantly positive in both columns 1 and 2 (one-sided p = 0.002 and 0.011, respectively), suggesting that our inference is robust to the alternative measures of pay duration.

TABLE 5. Pay duration and bad news management forecasts: Alternative measures of pay duration

	(1) Annual *P_DURATION*		(2) Cumulative *P_DURATION*	
	Coefficient	*p*-value	Coefficient	*p*-value
P_DURATION (H1: +)	0.1993***	0.002	0.1333**	0.011
EQ_COMP	−0.2887**	0.043	−0.1105	0.353
SHARE_OWN	−0.4689	0.124	−0.5032*	0.065
OPTION_GRANT	0.0544**	0.020	0.0651***	0.003
INST	0.6295***	0.000	0.6081***	0.000
AC	0.0140***	0.003	0.0136***	0.004
DISP	−1.0045***	0.000	−1.0720***	0.000
RVOL	−0.0818***	0.001	−0.0811***	0.002
BIND	0.0849*	0.076	0.0985**	0.035
LIT	0.0698	0.497	0.0310	0.762
SIZE	0.0475**	0.019	0.0588***	0.004
MTB	−0.0183**	0.024	−0.0178**	0.022
EQ_ISS	−0.1664**	0.017	−0.1737**	0.015
RET	−0.0219	0.647	−0.0311	0.546
CHG_ROA	−0.6212***	0.000	−0.5956***	0.000
Industry indicators	Included		Included	
Year indicators	Included		Included	
N	7,536		7,536	
Pseudo R^2	0.1786		0.1777	

Notes: This table reports the results of the probit regressions of the likelihood of the issuance of bad news forecasts using an alternative measure of pay duration, which is the weighted average of the vesting periods of the restricted stock and stock option. For firms with no CEO equity-based compensation, this variable takes a value of 0. In column 1, P_DURATION is the annual measure of pay duration, and in column 2, P_DURATION is the cumulative measure of pay duration, which incorporates the stock and option grants awarded in the current and previous years. In both columns, the pay duration variable is a predicted value estimated from the first-stage regression as reported in Table 3, except that the corresponding alternative pay duration measure is used. Appendix B provides the variable definitions. All of the continuous variables are winsorized at the 1% and 99% levels. The p-values are one-sided for the coefficient on P_DURATION and two-sided otherwise. The p-values are calculated based on standard errors adjusted for firm- and year-clustering. Since the regression includes year-fixed effects, year-clustering standard errors are further adjusted following Cameron and Miller (2015). ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

[35] In untabulated analyses, we separately examine the effect of pay duration on annual and quarterly forecasts. We find that P_DURATION is significantly positively associated with bad news disclosure based on annual forecasts but not based on quarterly forecasts. This result is worth noting because relative to short-run forecasts, long-run forecasts are motivated by the incentive alignment to a larger extent and thus are more important in reducing information asymmetry (Barth, 2003; Chen et al., 2008). In contrast, short-run forecasts are generally motivated by period-specific performance (Miller, 2002; Skinner, 1994) or litigation concerns (Kasznik & Lev, 1995; Skinner, 1994).

[36] The measure is set to 0 for observations without equity-based compensation. The predicted value of pay duration is obtained by estimating Equation (1) with P_DURATION, STATE_P_DURATION, and IND_P_DURATION being replaced by the corresponding alternative measures of pay duration.

Table 6 reports the results of the ordinary least squares (OLS) regression, where we conduct a change analysis as an alternative way of alleviating the endogeneity concern. Specifically, we examine whether the change in pay duration is associated with the change in the likelihood of issuing bad news earnings forecasts.[37] In this analysis, the dependent variable takes values of −1, 0, and 1 for a decrease, no change, and an increase in the likelihood of bad news issuance, respectively. The results in columns 1 and 2 indicate that the coefficient on ΔP_DURATION is significantly positive (one-sided p = 0.037 and 0.021, respectively), suggesting that our inference is robust to controlling for time-invariant unobservable firm characteristics.[38]

TABLE 6. Pay duration and bad news management forecasts: A change analysis

	(1) Annual *P_DURATION*		(2) Cumulative *P_DURATION*	
	Coefficient	*p*-value	Coefficient	*p*-value
ΔP_DURATION (H1: +)	0.0135**	0.037	0.0158**	0.021
ΔEQ_COMP	−0.0591**	0.027	−0.0536*	0.067
ΔSHARE_OWN	−0.1574	0.607	−0.1474	0.628
ΔOPTION_GRANT	0.0038	0.668	0.0037	0.683
ΔINST	0.0522	0.151	0.0517	0.172
ΔAC	0.0035**	0.046	0.0036**	0.041
ΔDISP	−0.0335**	0.029	−0.0349**	0.020
ΔRVOL	−0.0028	0.715	−0.0031	0.678
ΔBIND	−0.0457***	0.008	−0.0460***	0.007
ΔLIT	0.1466***	0.002	0.1461***	0.002
ΔSIZE	0.1065***	0.000	0.1062***	0.000
ΔMTB	−0.0004	0.856	−0.0003	0.903
ΔEQ_ISS	0.0189***	0.008	0.0187***	0.008
ΔRET	−0.0303**	0.021	−0.0307**	0.019
ΔROA	−0.2036***	0.000	−0.2024***	0.000
N	5,248		5,248	
Adjusted R^2	0.0108		0.0108	

Notes: This table reports the results of the ordinary least squares (OLS) regression of the changes in the likelihood of issuing bad news earnings forecasts on the changes in pay duration. The dependent variable ΔD_MF refers to the change in the indicator variable for the issuance of bad news earnings forecast from year t to t+1. ΔP_DURATION is the change in pay duration from year t–1 to t. In column 1, P_DURATION is the annual measure of pay duration, and in column 2, P_DURATION is the cumulative measure of pay duration, which incorporates the stock and option grants awarded in the current and previous years. The other explanatory variables are also measured as the changes from year t–1 to year t (or from year t to t+1). Appendix B provides the variable definitions. All of the continuous variables are winsorized at the 1% and 99% levels. The p-values are one-sided for the coefficient on ΔP_DURATION and two-sided otherwise. The p-values are calculated based on standard errors adjusted for firm and year clustering.

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

[37] We calculate the change in pay duration using the raw value, not the predicted value, of pay duration.
[38] The results are relatively weak, which is not very surprising because a firm's forecasting behavior is not expected to change by a large extent over two years.

4.4 Effect of pay duration on forecast accuracy

Pay duration can affect the quality of management forecasts if longer pay durations motivate managers to exert more effort in discovering high-quality information and/or to spend more time analyzing and interpreting the newly acquired information.[39] We thus examine the effect of pay duration on the accuracy of management forecasts. We define MF_ACCURACY as (−1) times the average forecast error of bad news earnings forecasts issued in a given year. Forecast error is calculated as the absolute value of the difference between forecasted earnings and actual earnings, scaled by the stock price at the beginning of the fiscal year.[40] For range forecasts, we use the midpoint of the range as managers' forecasts. We then regress MF_ACCURACY on pay duration and the control variables using the following specification:

$$\begin{aligned} MF\_ACCURACY_{i,t+1} = {} & \gamma_0 + \gamma_1 P\_DURATION_{i,t} + \gamma_2 EQ\_COMP_{i,t} + \gamma_3 SHARE\_OWN_{i,t} \\ & + \gamma_4 OPTION\_GRANTT_{i,t+1} + \gamma_5 INST_{i,t} + \gamma_6 AC_{i,t} + \gamma_7 DISP_{i,t} + \gamma_8 RVOL_{i,t+1} \\ & + \gamma_9 BIND_{i,t} + \gamma_{10} LIT_{i,t} + \gamma_{11} SIZE_{i,t} + \gamma_{12} MTB_{i,t} + \gamma_{13} EQ\_ISS_{i,t} + \gamma_{14} RET_{i,t+1} \\ & + \gamma_{15} LOSS_{i,t+1} + \gamma_{16} CHG\_ROA_{i,t+1} + \gamma_{17} MF\_HORIZON_{i,t+1} \\ & + \gamma_{18} MF\_SURPRISE_{i,t+1} + \gamma_{19} IMR_{i,t+1} + Industry\ Indicators \\ & + Year\ Indicators + \mu_{i,t+1} \end{aligned} \quad (3)$$

To address the potential selection bias, we include the inverse Mills ratio (IMR) calculated from Equation (2) to control for the likelihood of bad news forecasts. In addition to the control variables included in Equation (2), we follow prior studies and control for the existence of performance loss (LOSS), forecast horizon (MF_HORIZON), and forecast surprise (MF_SURPRISE). Appendix B provides the definitions of these variables.

Table 7 reports the regression results. The coefficient on P_DURATION is significantly positive in both columns 1 and 2 (two-sided $p < 0.001$), suggesting that managers with longer pay durations provide more accurate bad news earnings forecasts. These results indicate that longer pay durations improve not only the quantity but also the quality of bad news forecasts.

[39] Relatedly, Brockman et al. (2019) find that CEOs with longer internal experience are more likely to issue earnings forecasts and that their forecasts are more accurate because they have a much better understanding of their firms' operating environments.

[40] To avoid a small deflator problem, firm-years with stock prices smaller than $1 are excluded from the analysis. As a result, the analysis is based on 2633 firm-year observations.

TABLE 7. Pay duration and management forecast accuracy

	(1)		(2)	
	Annual *P_DURATION*		Cumulative *P_DURATION*	
	Coefficient	*p*-value	Coefficient	*p*-value
P_DURATION	0.0100***	0.000	0.0070***	0.000
EQ_COMP	−0.0178***	0.000	−0.0079***	0.004
SHARE_OWN	−0.0111	0.318	−0.0119	0.269
OPTION_GRANT	0.0023***	0.001	0.0025***	0.000
INST	0.0185***	0.005	0.0187***	0.004
AC	0.0004***	0.002	0.0004***	0.001
DISP	−0.0352***	0.001	−0.0367***	0.001
RVOL	−0.0044***	0.000	−0.0045***	0.000
BIND	0.0024**	0.027	0.0030***	0.008
LIT	0.0019*	0.094	0.0017	0.120
SIZE	−0.0002	0.767	0.0003	0.442
MTB	−0.0004*	0.061	−0.0003	0.124
EQ_ISS	−0.0036**	0.021	−0.0037**	0.017
RET	−0.0041***	0.000	−0.0043***	0.000
CHG_ROA	−0.0187**	0.038	−0.0048***	0.000
LOSS	−0.0048***	0.000	−0.0194**	0.031
MF_HORIZON	−0.0063***	0.000	−0.0063***	0.000
MF_SURPRISE	−0.6083***	0.000	−0.6093***	0.000
IMR	0.0431***	0.002	0.0433***	0.002
Industry indicators	Included		Included	
Year indicators	Included		Included	
N	2,633		2,633	
Adjusted R^2	0.3315		0.3313	

Notes: This table reports the results of the ordinary least squares (OLS) regression of forecast accuracy (MF_ACCURACY) on pay duration and the control variables. In column 1, P_DURATION is the annual measure of pay duration, and in column 2, P_DURATION is the cumulative measure of pay duration, which incorporates the stock and option grants awarded in the current and previous years. In both columns, the pay duration variable is a predicted value estimated from the first-stage regression, as reported in Table 3 (the predicted value of cumulative P_DURATION is based on a similar model). Appendix B provides the variable definitions. All of the continuous variables are winsorized at the 1% and 99% levels. All of the p-values are two-sided and are based on standard errors adjusted for firm- and year-clustering. Since the regression includes year-fixed effects, year-clustering standard errors are further adjusted following Cameron and Miller (2015).

***, **, and * denote two-tailed significance at the 1%, 5%, and 10% levels, respectively.

4.5 Cross-sectional variation in the effect of pay duration: Tests of H2–H5

To test each of the cross-sectional hypotheses, we construct an indicator variable for each situation under which we expect the effect of pay duration to be stronger and then add the indicator variable and its interaction with pay duration to Equation (2). In Table 8, we report the results when we test each hypothesis separately, but our inferences are the same when we test all of the hypotheses at the same time by including all of the cross-sectional variables in one regression (results untabulated).

TABLE 8. Cross-sectional analyses of the effect of pay duration

Panel A: Annual *P_DURATION*

Tests for	Corporate monitoring				Information environment				Litigation risk		Industry homogeneity	
	(1)		(2)		(3)		(4)		(5)		(6)	
XS_VAR =	*LOW_BIND*		*LOW_INST*		*LOW_AC*		*LOW_TO*		*LOW_LIT*		*IND_HOMOGENEITY*	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
P_DURATION	0.2157***	0.006	0.2760***	0.000	0.2206**	0.021	0.1778**	0.015	0.8792***	0.000	0.8413***	0.000
XS_VAR	−0.3896***	0.000	−0.4344***	0.000	−0.3605***	0.001	−0.0788	0.444	−0.6133***	0.000	−0.5102***	0.000
P_DURATION × *XS_VAR*	0.2234***	0.001	0.1828***	0.000	0.0917**	0.038	0.1388***	0.002	0.2340***	0.000	0.1831***	0.006
EQ_COMP	−0.4784***	0.006	−0.6410***	0.001	−0.4784**	0.017	−0.3818**	0.012	−2.1220***	0.000	−1.8872***	0.000
SHARE_OWN	−0.5445*	0.061	−0.5337*	0.055	−0.6006**	0.031	−0.6166**	0.030	0.1458	0.647	−0.0701	0.819
OPTION_GRANT	0.0604***	0.007	0.0571**	0.011	0.0588***	0.009	0.0602***	0.007	0.0418	0.113	0.0325	0.226
INST	0.6038***	0.000			0.5698***	0.000	0.6688***	0.000	0.6708***	0.000	0.6344***	0.000
AC	0.0112**	0.021	0.0118**	0.014			0.0144***	0.007	0.0132***	0.004	0.0124***	0.006
DISP	−1.0127***	0.000	−1.0040***	0.000	−1.0120***	0.000	−1.0023***	0.000	−0.9898***	0.000	−0.9719***	0.000
RVOL	−0.0811***	0.001	−0.0833***	0.001	−0.0814***	0.001	−0.0719***	0.005	−0.1193***	0.000	−0.1175***	0.000
BIND			0.0888*	0.071	0.0791	0.118	0.0862*	0.068	0.0712	0.127	0.0867*	0.076
LIT	0.0447	0.668	0.0529	0.609	0.0458	0.648	0.0529	0.606			0.2100***	0.000
SIZE	0.0325	0.128	0.0134	0.532	0.0231	0.275	0.0257	0.264	−0.1268***	0.000	−0.0968***	0.000
MTB	−0.0219***	0.009	−0.0230***	0.006	−0.0235***	0.005	−0.0218***	0.008	−0.0310***	0.000	−0.0309***	0.000
EQ_ISS	−0.1680**	0.013	−0.1760**	0.012	−0.1692**	0.010	−0.1661**	0.030	−0.3901***	0.000	−0.3508***	0.000
RET	−0.0209	0.670	−0.0201	0.680	−0.0223	0.637	−0.0209	0.643	0.0240	0.733	0.0233	0.747
CHG_ROA	−0.6074***	0.000	−0.6024***	0.000	−0.6086***	0.000	−0.6080***	0.000	−0.5631***	0.000	−0.5537***	0.001
Industry indicators	Included		Included		Included		Included					
Year indicators	Included		Included		Included		Included		Included		Included	

Panel A: Annual *P_DURATION*

Tests for	Corporate monitoring				Information environment				Litigation risk		Industry homogeneity	
	(1)		(2)		(3)		(4)		(5)		(6)	
XS_VAR =	*LOW_BIND*		*LOW_INST*		*LOW_AC*		*LOW_TO*		*LOW_LIT*		*IND_HOMOGENEITY*	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
N	7,536		7,536		7,536		7,536		7,536		7,536	
Pseudo R^2	0.1799		0.1769		0.1805		0.1810		0.0997		0.1030	
F-tests: *P_DURATION* + *P_DURATION* × *XS_VAR* = 0												
	0.4391***	0.000	0.4588***	0.000	0.3123***	0.001	0.3166***	0.000	1.1131***	0.000	1.0244***	0.000

Panel B: Cumulative *P_DURATION*

Tests for	Corporate monitoring				Information environment				Litigation risk		Industry homogeneity	
	(1)		(2)		(3)		(4)		(5)		(6)	
XS_VAR =	*LOW_BIND*		*LOW_INST*		*LOW_AC*		*LOW_TO*		*LOW_LIT*		*IND_HOMOGENEITY*	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
P_DURATION	0.1514	0.180	0.1973	0.140	0.1705	0.164	0.1107	0.379	0.6595***	0.001	0.6789***	0.000
XS_VAR	−0.4658***	0.000	−0.4559***	0.000	−0.3639***	0.002	−0.1076	0.302	−0.7042***	0.000	−0.6088***	0.000
P_DURATION × *XS_VAR*	0.2745***	0.001	0.2060***	0.001	0.0955*	0.064	0.1636***	0.001	0.2969***	0.000	0.2443***	0.001
EQ_COMP	−0.2656	0.238	−0.3608	0.151	−0.2737	0.226	−0.1764	0.469	−1.3369***	0.000	−1.2287***	0.000
SHARE_OWN	−0.5293*	0.068	−0.5285*	0.059	−0.5964**	0.034	−0.6198**	0.035	0.1265	0.702	−0.0868	0.783
OPTION_GRANT	0.0649***	0.003	0.0629***	0.004	0.0629***	0.004	0.0642***	0.003	0.0574**	0.022	0.0449*	0.079
INST	0.6015***	0.000			0.5703***	0.000	0.6690***	0.000	0.6527***	0.000	0.6105***	0.000
AC	0.0115**	0.016	0.0122***	0.010			0.0146***	0.005	0.0138***	0.003	0.0127***	0.007
DISP	−1.0426***	0.000	−1.0442***	0.000	−1.0425***	0.000	−1.0301***	0.000	−1.0836***	0.000	−1.0496***	0.000
RVOL	−0.0829***	0.001	−0.0867***	0.001	−0.0835***	0.001	−0.0739***	0.004	−0.1335***	0.000	−0.1297***	0.000
BIND			0.1053**	0.027	0.0906*	0.057	0.0978**	0.030	0.1199***	0.008	0.1294***	0.006

Panel B: Cumulative *P_DURATION*												
Tests for	Corporate monitoring				Information environment				Litigation risk		Industry homogeneity	
	(1)		(2)		(3)		(4)		(5)		(6)	
XS_VAR =	*LOW_BIND*		*LOW_INST*		*LOW_AC*		*LOW_TO*		*LOW_LIT*		*IND_HOMOGENEITY*	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
LIT	0.0435	0.687	0.0519	0.628	0.0451	0.663	0.0510	0.631			0.2177***	0.000
SIZE	0.0435**	0.033	0.0289	0.156	0.0338*	0.084	0.0365	0.101	-0.0857***	0.000	-0.0598***	0.002
MTB	−0.0202**	0.015	−0.0205**	0.012	−0.0216***	0.009	−0.0201**	0.013	−0.0240***	0.003	−0.0248***	0.004
EQ_ISS	−0.1722**	0.012	−0.1836**	0.010	−0.1737***	0.009	−0.1697**	0.028	−0.4241***	0.000	−0.3792***	0.000
RET	−0.0253	0.608	−0.0261	0.596	−0.0265	0.582	−0.0240	0.603	0.0170	0.816	0.0169	0.821
CHG_ROA	−0.6222***	0.000	−0.6237***	0.000	−0.6237***	0.000	−0.6231***	0.000	−0.6385***	0.000	−0.6210***	0.000
Industry indicators	Included		Included		Included		Included					
Year indicators	Included		Included		Included		Included		Included		Included	
N	7,536		7,536		7,536		7,536		7,536		7,536	
Pseudo R^2	0.1799		0.1766		0.1805		0.1810		0.0972		0.1015	
F-tests: *P_DURATION* + *P_DURATION* × *XS_VAR* = 0												
	0.4258***	0.004	0.4030***	0.004	0.2659**	0.029	0.2744**	0.041	0.9564***	0.000	0.9232***	0.000

Notes: This table reports the results of the probit regression of the likelihood of the issuance of bad news forecasts to test the cross-sectional variation in the effect of pay duration with corporate monitoring (columns 1 and 2), information environment quality (columns 3 and 4), litigation risk (column 5), and industry homogeneity (column 6). In Panel A, P_DURATION is the annual measure of pay duration and, in Panel B, P_DURATION is the cumulative measure of pay duration, which incorporates the stock and option grants awarded in the current and previous years. In both panels, the pay duration variable is a predicted value estimated from the first-stage regression as reported in Table 3 (the predicted value of cumulative P_DURATION is based on a similar model). In both Panels A and B, XS_VAR represents the cross-sectional variable and P_DURATION × XS_VAR represents the product of P_DURATION and XS_VAR. In columns 1 through 6, the cross-sectional variable (i.e., XS_VAR) is LOW_BIND, LOW_INST, LOW_AC, LOW_TO, LOW_LIT, and IND_HOMOGENEITY, respectively. Appendix B provides the variable definitions. All of the continuous variables are winsorized at the 1% and 99% levels. The p-values are one-sided for the coefficients on the interaction terms and two-sided otherwise. The p-values are calculated based on standard errors adjusted for firm- and year-clustering. Since the regression includes year-fixed effects, year-clustering standard errors are further adjusted following Cameron and Miller (2015). ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

To test H2, we use two proxies to capture the effectiveness of corporate monitoring: Board independence and institutional ownership (e.g., Ajinkya et al., 2005). Specifically, we follow Chen et al. (2008) and construct an indicator variable, LOW_BIND, for firms with less independent boards, which equals 1 if less than 60% of the firm's directors are independent and 0 otherwise. Similarly, we construct another indicator variable, LOW_INST, for firms with lower institutional ownership, which equals 1 if the firm's institutional ownership is below the sample median and 0 otherwise.[41]

Panel A of Table 8 reports the regression results when the annual measure of pay duration is used. In columns 1 and 2, where XS_VAR (i.e., the cross-sectional variable) represents LOW_BIND and LOW_INST, respectively, the coefficient on the interaction of P_DURATION with XS_VAR is significantly positive in both columns (one-sided p = 0.001 and 0.000, respectively). Similarly, in Panel B, where the cumulative measure of pay duration is used, the coefficient on the interaction of P_DURATION with XS_VAR is also significantly positive in both columns (one-sided p = 0.001 in both columns). Note that in Panel B, the coefficient on P_DURATION is not significant in columns 1 and 2, suggesting that longer pay durations do not have incremental effects on bad news disclosures for firms with strong monitoring. However, as indicated by the F-test (reported at the bottom of the table), the total effect of P_DURATION and P_DURATION × XS_VAR is significantly positive in columns 1 and 2 (one-sided p = 0.004 in both columns). Overall, these results are consistent with H2 that the effect of pay duration on bad news disclosure is greater for firms with weaker corporate monitoring.

[41] As we include the indicator variable for lower levels of board independence (LOW_BIND) in the cross-sectional analysis, we remove the original control variable (BIND) from the regression model. We do the same for institutional ownership (INST), analyst coverage (AC), and litigation risk (LIT) in the respective cross-sectional tests.

To test H3, we use two proxies to capture the quality of the information environment: Analyst coverage and share turnover. Prior research has found that analyst coverage is positively correlated with the quality of the information environment, as financial analysts tend to follow firms with rich information environments and help increase the amount of information available to investors (e.g., Healy & Palepu, 2001). Similarly, a large number of studies find that trading volume increases when information asymmetry decreases as a result of public disclosures (e.g., Leuz & Verrecchia, 2000; Lo et al., 2004). Specifically, we construct an indicator variable, LOW_AC, which equals 1 if a firm's analyst coverage (AC) is below the sample median and 0 otherwise. Similarly, we construct another indicator variable, LOW_TO, which equals 1 if the firm's share turnover (calculated as the median daily trading volume scaled by the total number of shares outstanding) is below the sample median and 0 otherwise.

Table 8 reports the regression results, with column 3 standing for analyst coverage and column 4 for share turnover. In columns 3 and 4, XS_VAR represents LOW_AC and LOW_TO, respectively. In Panel A, when the annual measure of pay duration is used, the coefficient on the interaction of P_DURATION with XS_VAR is significantly positive in both columns (one-sided p = 0.038 and 0.002, respectively). In Panel B, when the cumulative measure of pay duration is used, the coefficient on the interaction variable continues to be significantly positive in both columns (one-sided p = 0.064 and 0.001, respectively). Note that the coefficient on P_DURATION is not significant in columns 3 and 4 of Panel B, suggesting that longer pay durations do not have incremental effects on bad news disclosures for firms with richer information environments. However, as indicated by the F-test, the total effect of P_DURATION and P_DURATION × XS_VAR is significantly positive in columns 3 and 4 (one-sided p = 0.029 and 0.041, respectively). Overall, these results are consistent with H3 that the effect of pay duration on bad news disclosure is stronger for firms with poorer information environments.

To test H4, we construct an indicator variable for firms facing lower litigation risk, LOW_LIT, which equals 1 for firms not operating in litigious industries (i.e., Standard Industry Classification (SIC) code not within 2844–2836, 3570–3577, 7370–7374, 3600–3674, 5200–5961, or 8731–8734) and 0 otherwise. Column 5 of Table 8 reports the regression results with XS_VAR representing LOW_LIT.[42] In both Panels A and B, we find that the coefficient on P_DURATION × XS_VAR is significantly positive (one-sided p < 0.001 in both panels). That is, consistent with H4, pay duration elicits bad news disclosures more effectively for firms facing lower litigation risk (i.e., those with lower ex-ante incentives to disclose bad news).

To test H5, we construct an indicator variable for firms operating in more homogenous industries, IND_HOMOGENEITY, which equals 1 for firms operating in an industry whose degree of industry homogeneity is above the sample median and 0 otherwise.[43] Column 6 of Table 8 reports the regression results with XS_VAR representing IND_HOMOGENEITY. In both Panels A and B, we find that the coefficient on P_DURATION × XS_VAR is significantly positive (one-sided p = 0.006 and 0.001, respectively). That is, consistent with H5, pay duration elicits bad news disclosures more effectively when firms operate in more homogeneous industries, in which managers have lower incentives to disclose bad news due to more severe career concerns.

[42] As LOW_LIT is defined based on industry membership, we do not include industry-fixed effects in column 5 of Table 8. We do the same for the test of H5 (industry homogeneity) in column 6 of Table 8.

[43] Following Parrino (1997), we first calculate, for each firm in an industry (based on two-digit SIC industry), the percentage of the variation in monthly stock returns that is explained by an equal-weighted industry index over the previous 10 years, and we then measure the industry homogeneity as the median across all firms in the industry.

5 ADDITIONAL ANALYSES

5.1 Conditioning on bad news incidence

Bad news issuance is conditional upon the incidence of bad news. In other words, firms must have bad news to disclose. Although we include RET and CHG_ROA as control variables, we take a more refined approach to address this issue. More specifically, in Table 9, we perform the regression separately for the firms that are likely to have experienced bad news and firms that are not. We regard a firm as being more likely to have bad news if its annual stock return or annual change in return on assets is negative.[44] In Panel A, when the annual measure is used, the coefficient on P_DURATION is significantly positive in columns 1 and 2, which are based on a subset of firms that have experienced bad news (i.e., RET < 0 and CHG_ROA < 0, respectively). However, the coefficient is not significant in columns 3 and 4, which are based on a subset of firms that have not experienced bad news (i.e., RET ≥ 0 and CHG_ROA ≥ 0, respectively). These results suggest that long pay durations encourage managers to disclose bad news, conditional on having bad news. In Panel B, where the cumulative measure is used, the results are overall similar although their significance is somewhat weaker.[45]

TABLE 9. Pay duration and bad news management forecasts conditional on bad news incidence

Panel A: Annual *P_DURATION*								
	(1) *RET* < 0		(2) *CHG_ROA* < 0		(3) *RET* ≥ 0		(4) *CHG_ROA* ≥ 0	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
P_DURATION	0.3285*	0.055	0.5230***	0.000	0.1751	0.234	0.0127	0.476
EQ_COMP	−0.5969	0.217	−1.0135***	0.002	−0.2625	0.630	0.1234	0.791
SHARE_OWN	−0.6749**	0.046	−0.3496	0.243	−0.4986	0.203	−0.9397**	0.035
OPTION_GRANT	0.0654***	0.001	0.0384*	0.063	0.0561***	0.007	0.0846**	0.019
INST	0.5823***	0.000	0.5338***	0.001	0.6688***	0.000	0.6600***	0.000
AC	0.0138***	0.004	0.0183**	0.025	0.0094*	0.052	0.0057	0.357
DISP	−0.9576***	0.000	−1.4118***	0.000	−1.0956***	0.000	−0.8387***	0.000
RVOL	−0.0662*	0.053	−0.0389*	0.079	−0.1129***	0.000	−0.1108***	0.002
BIND	−0.0215	0.740	0.0592	0.250	0.1869***	0.002	0.1172***	0.007
LIT	−0.0085	0.954	0.0562	0.682	0.087	0.495	0.0614	0.608
SIZE	0.0333	0.325	0.0039	0.906	0.0256	0.581	0.0448	0.181
MTB	−0.0213**	0.014	−0.0256*	0.065	−0.0238	0.108	−0.0197*	0.090
EQ_ISS	−0.2797**	0.045	−0.1615**	0.038	−0.0683	0.410	−0.1802**	0.035
RET	0.0437	0.871	−0.2610***	0.000	−0.0284	0.732	0.1395**	0.021
CHG_ROA	−0.7423***	0.001	0.1191	0.670	−0.3435*	0.078	−1.6787***	0.000

[44] We define bad news as managers' forecasts relative to analyst expectations. A firm is regarded as disclosing bad news if its own forecast is lower than analyst expectations. As a result, it is practically impossible to observe whether a firm has bad news if the firm does not issue an earnings forecast. We use negative returns and changes in ROA as a noisy proxy for bad news, as firms are more likely to have bad news if their performance is poorer.

[45] Relatedly, an untabulated analysis indicates that our sample firms have significantly poorer stock and accounting performance during our sample period than in the period before or after it (i.e., 2001 to 2005 or 2011 to 2014, respectively). As a result, managerial discretion in disclosing bad news (conditional on having bad news) is probably greater during our sample period, which provides us with a more powerful setting to detect the effect of pay duration on bad news disclosure.

Panel A: Annual *P_DURATION*								
	(1) *RET* < 0		(2) *CHG_ROA* < 0		(3) *RET* ≥ 0		(4) *CHG_ROA* ≥ 0	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
Industry indicators	Included		Included		Included		Included	
Year indicators	Included		Included		Included		Included	
N	3,897		3,825		3,639		3,711	
Pseudo R^2	0.1950		0.2020		0.1756		0.1735	
Panel B: Cumulative *P_DURATION*								
	(1) *RET* < 0		(2) *CHG_ROA* < 0		(3) *RET* ≥ 0		(4) *CHG_ROA* ≥ 0	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
P_DURATION	0.2801	0.119	0.3485*	0.065	0.1832	0.222	0.0801	0.348
EQ_COMP	−0.3662	0.432	−0.4735	0.312	−0.2002	0.654	0.0088	0.980
SHARE_OWN	−0.6623*	0.056	−0.4020	0.255	−0.4648	0.270	−0.8857*	0.051
OPTION_GRANT	0.0711***	0.001	0.0472**	0.031	0.0585***	0.004	0.0847**	0.021
INST	0.5788***	0.000	0.5386***	0.000	0.6660***	0.000	0.6547***	0.000
AC	0.0142***	0.002	0.0192**	0.016	0.0094**	0.046	0.0055	0.385
DISP	−0.9942***	0.000	−1.4761***	0.000	−1.1114***	0.000	−0.8343***	0.000
RVOL	−0.0690**	0.047	−0.0443*	0.060	−0.1133***	0.000	−0.1094***	0.002
BIND	−0.0078	0.909	0.0861	0.113	0.1923***	0.003	0.1141**	0.014
LIT	−0.0068	0.963	0.0451	0.714	0.0920	0.498	0.0711	0.587
SIZE	0.0460	0.139	0.0306	0.328	0.0302	0.422	0.0409	0.104

Panel B: Cumulative *P_DURATION*								
	(1) *RET* < 0		(2) *CHG_ROA* < 0		(3) *RET* ≥ 0		(4) *CHG_ROA* ≥ 0	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
MTB	−0.0192**	0.018	−0.0216	0.124	−0.0228	0.104	−0.0199*	0.074
EQ_ISS	−0.2868**	0.042	−0.1645**	0.039	−0.0743	0.347	−0.1852**	0.038
RET	0.0373	0.890	−0.2696***	0.000	−0.0303	0.722	0.1393**	0.020
CHG_ROA	−0.7627***	0.001	0.0904	0.751	−0.3534*	0.077	−1.6758***	0.000
Industry indicators	Included		Included		Included		Included	
Year indicators	Included		Included		Included		Included	
N	3,897		3,825		3,639		3,711	
Pseudo R^2	0.1950		0.2017		0.1756		0.1735	

Notes: This table reports the results of the probit regression of the likelihood of the issuance of bad news forecasts. We estimate the regression separately for the firms that are more likely to have experienced bad news (columns 1 and 2) and the firms that are less likely (columns 3 and 4). In Panel A, P_DURATION is the annual measure of pay duration, and in Panel B, P_DURATION is the cumulative measure of pay duration, which incorporates the stock and option grants awarded in the current and previous years. In both panels, the pay duration variable is a predicted value estimated from the first-stage regression as reported in Table 3 (the predicted value of cumulative P_DURATION is based on a similar model). Appendix B provides the variable definitions. All of the continuous variables are winsorized at the 1% and 99% levels. The p-values are one-sided for the coefficient on P_DURATION and two-sided otherwise. The p-values are calculated based on standard errors adjusted for firm- and year-clustering. Since the regression includes year-fixed effects, year-clustering standard errors are further adjusted following Cameron and Miller (2015).

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

5.2 Effect of pay duration on all management forecasts

As noted in Section 4.2, EQ_COMP is not positively correlated with bad news forecasts when pay duration is included in the analyses. This result is not necessarily inconsistent with that of Nagar et al. (2003), because they examine the issuance of all management forecasts, including both good and bad news forecasts. To reconcile our result with that of Nagar et al. (2003), we re-estimate Equation (2) after replacing the dependent variable with a new indicator for management forecasts, which equals 1 for firms that issue at least one earnings forecast (regardless of the nature of news) in a given year and 0 otherwise. Table 10 reports the results. In both columns 1 and 2, the coefficient on P_DURATION is significantly positive, while the coefficient on EQ_COMP is significantly negative. However, because P_DURATION is highly correlated with EQ_COMP, the common effect is not captured by either variable when both are included in the regression. In column 3, when we remove P_DURATION from

the regression, we find that the coefficient on EQ_COMP is significantly positive, consistent with Nagar et al. (2003). Therefore, while the incremental effect of EQ_COMP over pay duration is negative, its total effect on management forecasts is positive when pay duration is not included.[46]

TABLE 10. Pay duration and management forecasts (Including both good news and bad news)

	(1)		(2)		(3)	
	Annual *P_DURATION*		Cumulative *P_DURATION*		Exclusion of *P_DURATION*	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
P_DURATION	0.5357***	0.000	0.4114***	0.000		
EQ_COMP	−0.9473***	0.000	−0.4902**	0.021	0.2434***	0.001
SHARE_OWN	−0.4164	0.252	−0.4305	0.232	−0.7432**	0.030
OPTION_GRANT	0.0600***	0.005	0.0686***	0.001	0.0702***	0.001
INST	0.6485***	0.000	0.6468***	0.000	0.6775***	0.000
AC	0.0169**	0.010	0.0176***	0.008	0.0190***	0.003
DISP	−1.1514***	0.000	−1.2133***	0.000	−1.2474***	0.000
RVOL	−0.1422***	0.000	−0.1468***	0.000	−0.1557***	0.000
BIND	0.1197**	0.041	0.1447***	0.010	0.1678***	0.003
LIT	0.1414	0.267	0.1361	0.298	0.0767	0.550
SIZE	0.0047	0.881	0.0284	0.285	0.0550**	0.035
MTB	−0.0235***	0.005	−0.0198**	0.014	−0.0174**	0.031
EQ_ISS	−0.2510***	0.002	−0.2595***	0.001	−0.2312***	0.003
RET	0.0267	0.642	0.0185	0.745	0.0202	0.717
CHG_ROA	−0.1222	0.161	−0.1507*	0.071	−0.1443	0.113
Industry indicators	Included		Included		Included	
Year indicators	Included		Included		Included	
N	7,536		7,536		7,536	
Pseudo R^2	0.2577		0.2576		0.2570	

Notes: This table reports the results of the probit regression of the likelihood of issuance of all management forecasts, including both good news and bad news forecasts. In column 1, *P_DURATION* is the annual measure of pay duration, and in column 2, *P_DURATION* is the cumulative measure of pay duration, which incorporates the stock and option grants awarded in the current and previous years. In both columns, the pay duration variable is a predicted value estimated from the first-stage regression as reported in Table 3 (the predicted value of cumulative *P_DURATION* is based on a similar model). Appendix B provides the variable definitions. All of the continuous variables are winsorized at the 1% and 99% levels. All of the *p*-values are two-sided and are calculated based on standard errors adjusted for firm- and year-clustering. Since the regression includes year-fixed effects, year-clustering standard errors are further adjusted following Cameron and Miller (2015). ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

6 CONCLUSION

We investigate the effect of managers' pay duration on voluntary disclosures. We find that managers with long pay durations are more likely to issue bad news earnings forecasts than those with short pay durations. This result holds after we control for the endogeneity of pay duration using an instrumental variable approach. We obtain the same inference whether we use an annual or a cumulative measure

[46] We also examine the effect of pay duration on the likelihood of good news forecasts for completeness. The untabulated results indicate that the coefficient on pay duration is significantly positive for good news forecasts. Taken along with Table 10, these results suggest that managers with longer pay durations generally make more transparent disclosures than those with shorter pay durations. One explanation is that longer pay durations reduce the overall agency problems (Gopalan et al., 2014), including those related to financial reporting and disclosure.

of pay duration. Our results are robust to an alternative measure of pay duration and a change specification. We also find that bad news earnings forecasts issued by managers with longer pay durations are more accurate. Moreover, we find that the effect of pay duration is more pronounced for firms with weaker monitoring and with poorer information environments. The effect is also greater for firms facing lower litigation risk and operating in more homogenous industries.

We acknowledge several limitations of our study. First, our results may still be affected by endogeneity, although we address the issue in multiple ways and endogeneity cannot explain all the cross-sectional results. Second, although we obtain the same inferences using alternative measures of pay duration, they do not perfectly capture managers' horizons. Third, management forecasts are only a part of the overall disclosure activities of a firm. They are unlikely to capture the other aspects of voluntary disclosure and the particular type of managers' private information that some studies of disclosure theory consider (e.g., Kumar et al., 2012). As a result, readers should interpret our results with some caution. Despite these limitations, our results indicate that increasing pay duration can effectively mitigate disclosure-related agency problems and motivate managers to convey bad news more promptly.

While we examine the relation between pay duration and voluntary disclosure in a US setting, it would be interesting to assess whether and how our results can be generalized in an international setting. Although, a lack of data prohibits us from investigating the effect of pay duration across different countries, Fernandes et al. (2013) find that US and non-US firms have similar practices in the use of equity-based compensation. Furthermore, Bryan et al. (2010) suggest that the agency theory-based effects of equity-based compensation are reasonably consistent across countries. Similar to the evidence obtained from a US setting, Lang et al. (2012) find lower transaction costs and greater liquidity for firms with greater transparency in an international setting, and Cao et al. (2017) report international evidence that management forecasts reduce the cost of capital. Therefore, it would be interesting to explore the relation between pay duration and voluntary disclosure in an international setting and to identify the conditions upon which the relation would be more or less pronounced by considering country-specific characteristics, such as pay practices or investor protection.

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CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

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APPENDIX A: EXAMPLE OF THE PAY DURATION CALCULATION

To illustrate the calculation of the pay duration variable, we suppose that in a year, two CEOs are awarded compensation packages with identical dollar amounts but different vesting requirements as described in the following table. It is further assumed that there is no other type of compensation. Note that these numbers are used for illustrative purposes only. We assume that the total amount of compensation is the same for the two CEOs so that we control for the level of compensation in the regression analyses.

	CEO A	CEO B
1. Salary ($)	730,000	730,000
2. Bonus ($)	320,000	320,000
3. Restricted stock ($)	1,700,000	1,700,000
- Vesting schedule	(i) $850,000 will vest immediately	(i) $850,000 will vest after three years
	(ii) $850,000 will vest after one year	(ii) $850,000 will vest after five years
4. Stock option ($)	1,250,000	1,250,000
- Vesting schedule	(i) $500,000 will vest after one year	(i) $500,000 will vest after three years
	(ii) $750,000 will vest after three years	(ii) $750,000 will vest after five years
Total Pay ($)	4,000,000	4,000,000

The two compensation packages have the same dollar value of total pay at $4,000,000. The level of stock-based compensation (i.e., restricted stock and stock option) scaled by total compensation is also the same for both packages (74%) as calculated here:

$$= \frac{1,700,000 + 1,250,000}{730,000 + 320,000 + 1,700,000 + 1,250,000} = 0.74$$

However, the two compensation packages have different vesting schedules. Specifically, CEO B's restricted stock and stock option grants have longer vesting periods than those of CEO A. As shown below, CEO A's pay duration is 0.90 years and CEO B's pay duration is 3.01 years.

(i) CEO A's pay duration is

$$= \frac{(850,000 \times 0 + 850,000 \times 1) + (500,000 \times 1 + 750,000 \times 3)}{730,000 + 320,000 + 1,700,000 + 1,250,000} = 0.90$$

(ii) CEO B's pay duration is

$$= \frac{(850,000 \times 3 + 850,000 \times 5) + (500,000 \times 3 + 750,000 \times 5)}{730,000 + 320,000 + 1,700,000 + 1,250,000} = 3.01$$

APPENDIX B: VARIABLE DEFINITIONS

Variable		Definition
Variables used in the probit regression of the likelihood of the issuance of bad news forecasts		
D_MF	=	Indicator variable that equals 1 if the firm issues bad news earnings forecasts at least once in the year and 0 otherwise.
P_DURATION	=	Pay duration, measured as the weighted average of the vesting periods of the four components of executive compensation (i.e., salary, bonus, restricted stock grants, and stock option grants), with the weight being the relative size of each compensation component. The vesting periods of salary and bonus are set to 0.
EQ_COMP	=	The sum of the value of stock option grants and the value of restricted stock grants divided by total compensation, where the value of option grants and restricted stock grants is the grant date fair value.
SHARE_OWN	=	The share ownership of a CEO, measured as the number of shares held by the CEO divided by the total number of shares outstanding for a firm.
OPTION_GRANT	=	The number of separate dates on which an option grant is awarded.
INST	=	Institutional ownership, measured as the fraction of the total outstanding shares held by institutional investors.
AC	=	Analyst coverage, defined as the number of analysts who issue annual earnings forecasts for the firm.
DISP	=	Analyst forecast dispersion, defined as the standard deviation of analyst earnings forecasts divided by the absolute value of the mean analyst forecast (using the summary statistics calculated last before the fiscal year-end in the I/B/E/S).
RVOL	=	Return volatility, measured as the standard deviation of the firm's daily stock returns measured over the fiscal year.
BIND	=	Board independence, which equals 1 if more than 60% of the firm's directors are independent and 0 otherwise.
LIT	=	Indicator variable for high litigation industries, which equals 1 if the SIC code is within 2844–2836, 3570–3577, 7370–7374, 3600–3674, 5200–5961, and 8731–8734 and 0 otherwise.
SIZE	=	Firm size, measured as the natural logarithm of total assets.
MTB	=	Market-to-book ratio, measured as the firm's market value of common equity divided by the book value of common equity.
EQ_ISS	=	Indicator variable that equals 1 if the firm issues any equity offerings during the year and 0 otherwise.
RET	=	Market-adjusted annual stock returns, measured as the annual stock returns minus the value-weighted annual market returns
CHG_ROA	=	Change in the return on assets (ROA) from the previous year to the current year, where ROA is measured as the income before extraordinary items divided by the lagged total assets.

Variable		Definition
Instrumental variables		
STATE_ P_DURATION	=	The state average pay duration, measured as the average pay duration of all firms in the same state in which the firm's headquarter is located.
IND_P_DURATION	=	The industry average pay duration, measured as the average pay duration of all firms in the same industry (two-digit SIC industry).
Additional variables used in the regression of management forecast accuracy		
MF_ACCURACY	=	Average management forecast accuracy, which is measured as −1 times the absolute value of the difference between bad news earnings forecast and actual earnings divided by the stock price at the beginning of the year.
LOSS	=	Indicator variable that equals 1 if the firm reports negative income before extraordinary items and 0 otherwise.
MF_HORIZON	=	The natural logarithm of 1 plus the number of days between the management forecast date and the earnings announcement date.
MF_SURPRISE	=	Management earnings forecast minus conditional analyst expectation divided by the stock price at the beginning of the year. Conditional analyst expectation is calculated following Rogers and Buskirk (2013).
IMR	=	Inverse Mills ratio calculated from Equation (2).
Additional Variables used in the Cross-Sectional Tests		
LOW_BIND	=	Indicator variable that equals 1 if less than 60% of directors are independent and 0 otherwise.
LOW_INST	=	Indicator variable that equals 1 if the firm's institutional ownership (*INST*) is below the sample median and 0 otherwise.
LOW_AC	=	Indicator variable that equals 1 if the firm's analyst coverage (*AC*) is below the sample median and 0 otherwise.
LOW_TO	=	Indicator variable that equals 1 if the firm's share turnover (measured as the median daily trading volume scaled by the total number of shares outstanding) is below the sample median and 0 otherwise.
LOW_LIT	=	Indicator variable that equals 1 for firms operating in less litigious industries (i.e., SIC codes not within 2844–2836, 3570–3577, 7370–7374, 3600–3674, 5200–5961, and 8731–8734) and 0 otherwise.
IND_HOMOGENEITY	=	Indicator that equals 1 if the firm operates in an industry whose measure of industry homogeneity is above the sample median and 0 otherwise. To measure industry homogeneity, we follow Parrino (1997) and first calculate, for each firm in a particular industry (based on its two-digit SIC code), the percentage of the variation in monthly stock returns that is explained by an equal-weighted industry index over the previous 10 years. We then measure industry homogeneity as the median across all firms in the industry.