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Monitoring agency conflicts: use of accounting and direct supervision

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Abstract

Purpose – Agency theory predicts that agents tend to have more information regarding their own talents and efforts than their principals. This information asymmetry enables chief executive officers (CEOs) to "shirk" or engage in actions that benefit themselves at the expense of shareholders. To circumvent this adverse outcome, firms engage in monitoring efforts. One method is monitoring through high-quality accounting information, which can alleviate agency conflicts by reducing information asymmetry. Direct observation of employees' performance is another monitoring method. This paper examines whether low accounting quality will increase a board's tendency to use direct observation to alleviate agency conflicts between managers and shareholders.

Design/methodology/approach – Monitoring through accounting entails evaluating CEO performance on financial performance targets; monitoring through direct observation involves evaluating CEO performance subjectively. This study uses (1) firms utilizing Big Four auditors, abnormal accruals and earnings' ability to predict future cash flows as proxies for accounting quality and (2) discretionary bonuses paid to CEOs as an indirect measure for a board's direct observation.

Findings – We find that a board is prone to employ direct observation to reduce agency conflicts that low accounting quality exacerbates.

Research limitations/implications – Because we obtain CEO compensation data from large public firms, findings in this study might be limited to large firms.

Practical implications – The findings in this study can be applied to other areas involving agency conflicts. For example, future research can examine a board's use of direct observation to determine the promotion or dismissal of executives if their firm has low accounting quality.

Originality/value – Our study shows that public firms can still utilize direct observation to mitigate agency conflicts that low-accounting quality aggravates, even though monitoring through accounting is often viewed as a more efficient monitoring mechanism in public firms.

Keywords CEO, Monitoring theory, Accounting quality

Paper type Research article

1. Introduction

In a principle–agent relationship, agents are assumed to have more information regarding their own talents and efforts than their principals have (Jensen & Meckling, 1976; Parks & Conlon, 1995). This information asymmetry enables executives to "shirk" or engage in actions that might hurt shareholders' interests (John, Li, & Pang, 2017; Parks & Conlon, 1995; Watts & Zimmerman, 1986). Direct supervision, monitoring through accounting information and other monitoring devices, however, help reduce agency conflicts (Jensen & Meckling, 1976; Tosi, Katz, & Gomez-Mejia, 1997). Accounting provides information on both executives' actions and performance. High-quality accounting decreases information asymmetry (Biddle & Hilary, 2006). Thus, accounting metrics are used to evaluate managers' performance and are included in their compensation contracts to mitigate agency costs (Smith & Watts, 1982; Watts & Zimmerman, 1990). However, such information can be manipulated, as executives may choose accounting methods that state results in ways more favorable to themselves than to stockholders (Tosi *et al.*, 1997).

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Monitoring increases principals' verifiable knowledge about agent behavior and thus reduces agency costs. The efficacy of monitoring through accounting to mitigate agency conflicts depends on the transparency and reliability of accounting information (Armstrong, Guay, & Weber, 2010; Parks & Conlon, 1995; Watts & Zimmerman, 1986; Stein, 2003). However, chief executive officers (CEOs) can manipulate accounting information, such as earnings and cash flows, for personal gain [1]. Because effective monitoring is necessary to mitigate agency conflicts between shareholders and management (Jensen & Meckling, 1976; Quigley, Hubbard, Ward, & Graffin, 2020), when accounting information is of low quality and monitoring through accounting becomes less effective, boards would resort to other monitoring mechanisms to alleviate agency conflicts.

Direct supervision is another monitoring method that boards can use to alleviate agency conflicts. Based on prior literature, direct supervision of CEO and management is defined as getting informed of actions and decisions of top management, the results and consequences of those actions and decisions and firm performance through various means other than accounting report and financial information, and evaluating CEO actions, performance and business risks based on the information obtained (Browning & Sparks, 2016; De Kluyver, 2013; Stafford & Schindlinger, 2019; White, 2014). The concept of direct supervision is often referred to in prior literature as observation, direct observation and direct monitoring. (Edmans, Gabaix, & Landier, 2009; Engel, Gordon, & Hayes, 2002; Ke, Petroni, & Safieddine, 1999; Rajan & Reichelstein, 2009; Ramalingegowda *et al.*, 2012; Tosi *et al.*, 1997; Welbourne, Balkin, & Gomez-Mejia, 1995). The board directors obtain firm information through various sources including visiting firms' primary operations, research and development department and other key divisions, meeting with key individuals, executives and CEOs, reading informal reports and materials prepared for board meetings, asking executive questions and observing interactions between the CEO and other senior team members. (Browning & Sparks, 2016; Rajan & Reichelstein, 2009; Stafford & Schindlinger, 2019; White, 2014). Board responsibilities also include assessing and overseeing enterprise risk, being vigilant about the use of company resources by management and major activities such as acquisitions (White, 2014). Besides financial information such as balance sheets, information on unique factors such as supply, demand and firm-specific activities are also essential in the assessments of firm risks (De Kluyver, 2013; White, 2014). Through examining minutes of board meetings, Schwartz-Ziv and Weisbach (2013) find that boards devote most of their time to playing a supervisory role that includes observing CEOs' actions and evaluating CEOs based on those actions.

Board monitoring involves measuring CEO performance, designing CEO compensation schemes and implementing rewards (Del Brio, Yoshikawa, Connelly, & Tan, 2013; Englund & Gerdin, 2015; Ke *et al.*, 1999; Kerr & Kren, 1992). In addition to accounting measures and direct supervision, boards can use stock returns and non-financial information (e.g. customer satisfaction) to evaluate CEO performance. However, given that inflating or deflating stock prices is often an important incentive for CEOs to manipulate accounting information and that low-quality accounting information causes stock mispricing, boards might not alleviate their concern of low accounting quality by evaluating CEOs with stock performance. In contrast to financial reports of public firms that must be externally audited and comply with accounting standards, non-financial information is not required to be audited nor should it follow externally prescribed standards. If management can manipulate accounting information, it can also manipulate non-financial information and probably with lower costs. When a board is concerned about low accounting quality, it might not consider evaluating CEO performance using stock returns or non-financial information as a more reliable monitoring method. Thus, it will likely resort to direct supervision to mitigate agency conflicts that low-accounting quality exacerbates.

Because board monitoring involves measuring CEO performance and implementing rewards (Ke *et al.*, 1999), monitoring through direct supervision entails a subjective evaluation (Baker, Gibbons, & Murphy, 1994; Nathan & Alexander, 1985; Rajan & Reichelstein, 2009),

while monitoring through accounting will result in CEO performance being evaluated by financial measures. In this study, a board's direct supervision is measured by the discretionary bonus a CEO receives. CEO cash incentive compensation includes formula bonuses and discretionary bonuses. Formula bonuses are based on objective performance measures, such as earnings targets. The board's directors determine discretionary bonuses with direct supervision of the CEO and subjective evaluation.

We use Big Four auditors, earnings' ability to predict future cash flows and abnormal accruals to measure accounting quality. This approach is used because the Big Four invest heavily in auditor training and facilities to provide high-quality audits as a way of protecting their reputation (DeAngelo, 1981; Krishnan, 2003; Teoh & Wong, 1993). Moreover, the association between current earnings and future cash flows has often been employed as a measure of earnings relevance and earnings quality in prior literature (Atwood, Drake, & Myers, 2010; Bandyopadhyay, Chen, Huang, & Jha, 2010; Kim & Kross, 2005). Utilizing a sample of EXECUCOMP firms between 2007 and 2016, the investigation finds that boards undertake direct supervision to mitigate agency conflicts that low-accounting quality exacerbates, and they are more likely to compensate executives with discretionary bonuses if firms have low accounting quality. These results hold after controlling for firm characteristics, firm performance, CEO tenure, year and industry effects.

For robustness, discretionary bonuses and formula bonuses are measured with both continuous and indicator variables. The regressions with the two alternative measures have consistent results. The study employs propensity score matching (PSM), Impact Threshold for a Confounding Variable (ITCV) (Frank, 2000) and firm fixed effects to control for potential endogeneity and to address the concern that other factors drive the relationship between the accounting quality measures and discretionary bonuses. In PSM, observations in which CEOs receive only discretionary bonuses are matched with observations in which CEOs receive only formula bonuses based on firm characteristics and firm performance. Regressions using the PSM sample and regressions controlling for firm fixed effects consistently reveal that firms with low accounting quality are more likely to apply discretionary bonuses to compensate CEOs. The ITCV analysis demonstrates that a missing variable is unlikely to induce a relationship between discretionary bonus payments and accounting quality. The findings are robust to winsorizing and alternative specifications of the regression models.

Our findings are relevant to academic researchers, practitioners and regulators. Alleviating agency conflicts is a primary concern of shareholders, board members and regulators. Ke *et al.* (1999) expect that owners of privately-held firms have better access to management and a greater incentive to observe management and thus will rely less on monitoring through accounting measures. Indeed, in their research, they found a significant positive association between return on assets and the level of CEO compensation for publicly-held insurers but revealed no such relationship for privately-held insurers. Our study shows that public firms can still utilize direct supervision to mitigate agency conflicts that low-accounting quality aggravates, even though monitoring through accounting is often viewed as a more efficient monitoring mechanism in public firms.

The rest of the paper is organized into sections. The next section discusses germane prior literature and develops the hypotheses. Then, the sample and research design are described. The results of the main regressions are subsequently presented. Next, robustness tests and additional analyses are discussed. The last section provides the conclusions.

2. Literature review and hypotheses

Agency conflicts between shareholders and executives result from the separation of ownership and control (Jensen & Meckling, 1976). Executives often do not have large ownership in the firms that they manage and have conflicting interests with shareholders. As such, they often place self-interest over the interest of shareholders (Carlon, Downs, & Wert-Gray, 2006).

Information asymmetry is another cause of agency conflicts. Managers are assumed to have more information regarding their own talents and efforts, as well as firm-specific information, than outside directors and shareholders have, but they do not always report information that is detrimental to their personal interests – such as information indicating poor performance or extraction of private benefits. This information asymmetry enables agents to "shirk" (Watts & Zimmerman, 1986; Parks & Conlon, 1995; Armstrong *et al.*, 2010; Verrecchia, 2001; Jensen & Meckling, 1976).

The information environment plays a central role in determining the extent of agency conflicts (Armstrong *et al.*, 2010). Agency theory avers that monitoring increases principals' verifiable knowledge about agent behavior and decreases the chance that they will overpay agents who shirk their duties or are dodgy, thus reducing agency costs (Jensen & Meckling, 1976; Parks & Conlon, 1995; Watts & Zimmerman, 1986). The board of directors holds a prominent responsibility for monitoring CEOs. Boards – which largely consist of outside directors – are therefore typically assumed to be at an informational disadvantage when monitoring CEOs owing to their relatively distal position. Accounting and financial reporting systems mitigate the information asymmetry by providing outside directors and shareholders with relevant and reliable information that aids in effective monitoring of CEOs and other executives (Armstrong *et al.*, 2010; Arya, Fellingham, & Young, 1993; Watts & Zimmerman, 1990).

As noted earlier, CEOs have incentives to conceal or misrepresent their information, and they do not always report information that is detrimental to their personal interests (Armstrong *et al.*, 2010; Arya *et al.*, 1993). Extant work has found that CEOs do indeed manipulate accounting information for personal gains: they can manage earnings to increase their compensation and inflate stock prices surrounding stock sales and option exercises (Cornett, Marcus, & Tehranian, 2008; Dechow & Sloan, 1991; Healy & Wahlen, 1999). Prior research has also discerned that firms' income-increasing abnormal accruals are associated with insider sales of abnormally plethoric numbers of stocks and exercises of unusually large quantities of CEO stock options (Beneish & Vargus, 2002; Bergstresser & Philippon, 2006). Additionally, firms are more likely to have income-decreasing discretionary accrual and miss earnings targets prior to granting large stock options (Baker, Collins, & Reitenga, 2003; McAnally, Srivastava, & Weaver, 2008). Management's manipulation of accounting information is not restricted to earnings management. They can also manipulate cashflows by changing cash flow categories. For example, before its collapse, Enron reported bank loans as cash flows from operations (Abdel-khalik, 2019; Smith, 2011).

When there is separation of ownership and management, effective monitoring is necessary to mitigate agency conflicts (Jensen & Meckling, 1976; Quigley *et al.*, 2020). The efficacy of a firm's accounting system in enabling effective monitoring and reducing agency conflicts depends on the transparency and reliability of accounting information (Armstrong *et al.*, 2010; Firth, 1997; Hodder & Hopkins, 2014; Stein, 2003; Watts & Zimmerman, 1986). Thus, if the firm's accounting information is of low quality, its board is more likely to use other monitoring methods to alleviate agency conflicts.

Existing work has manifested the importance of using accounting and direct supervision to alleviate agency conflicts and decrease a CEO's and other executives' questionable conduct (Dharwadkar, George, & Brandes, 2000; Jensen & Meckling, 1976). After examining minutes from 155 board meetings and 247 board-committee meetings of 11 Israeli companies, Schwartz-Ziv and Weisbach (2013) determined that most of the time boards play a supervisory role that includes observing CEOs' actions and evaluating CEOs based on those actions. Moreover, prior literature has shown that even shareholders in public companies might trade off monitoring through accounting for direct supervision if they have access to management. For instance, scholars discern that institutional investors likely have privileged access to management and inside information (Carleton, Nelson, & Weisbach, 1998) and that they may rely more on direct monitoring and less on monitoring through the use of accounting numbers (Holmstrom, 1979; Ke *et al.*, 1999; Prendergast, 2002; Ramalingegowda & Yu, 2012). If a firm

has low accounting quality, financial information might not reflect the firm's actual performance, only monitoring through accounting will lead to increased costs of failing to align the interests between the CEO and shareholders, and utilizing direct supervision will bring benefits of deterring CEO opportunistic behaviors that increase their own interests at the expense of shareholders. Thus, if a firm has low accounting quality, its board is more likely to choose monitoring through direct supervision to alleviate agency conflicts. The foregoing discussion thus leads to the study's overriding hypothesis.

H. Low accounting quality will increase a board's tendency to use direct supervision to alleviate agency conflicts between managers and shareholders.

3. Method

3.1 Measurement of research variables

3.1.1 Measure of direct supervision.. To motivate executives, compensation needs to be based on their efforts. Ideal performance measures would reflect executives' actions to increase shareholder wealth (Jensen & Murphy, 1990). In practice, firms often use objective measures to measure executives' efforts. Accounting measures, which are often used to evaluate CEO performance, are subject to various assumptions and cannot fully reflect a firm's actual performance. Objective measures used in contracting are noisy and do not fully capture CEO efforts. Any information about the agent's action that allows a more accurate judgment of the agent's performance can be used to improve the contract (Holmstrom, 1979). Private and qualitative information of executives' actions that benefit the firm provides incremental information about their efforts not captured by objective performance measures. Subjective assessments related to executives' contributions to their firms' value and discretionary compensation based on subjective performance evaluation can improve contracting by supplementing or even replacing objective performance measurements (Baker *et al.*, 1994; Bester & Münster, 2016). To better align the CEOs' compensation with their efforts, boards can include subjective assessments based on private and qualitative information in performance evaluation.

The monitoring role includes assessing CEO performance, designing CEO compensation schemes and implementing rewards (Del Brio *et al.*, 2013; Englund & Gerdin, 2015; Ke *et al.*, 1999; Kerr & Kren, 1992). Monitoring through accounting numbers results in CEO performance being evaluated with financial measures. Accounting numbers are used in managers' compensation contracts, and such use minimizes agency costs (Smith & Watts, 1982; Watts & Zimmerman, 1990). Subjective evaluation of an agent's performance reflects the principal's direct supervision (Baker *et al.*, 1994; Nathan & Alexander, 1985; Rajan & Reichelstein, 2009). Prior literature indicates that public information can supplement private information to improve the accuracy of a decision-maker's judgment (Duffie, Malamud, & Manso, 2010; Holmstrom, 1979; Tucker, 1997). Thus, a board's subjective evaluation is based on directors' private information, supplemented with public information. If a board chooses direct supervision as the monitoring mechanism, the directors are more likely to subjectively evaluate CEO performance based on their private information than if a board only relies on monitoring through accounting information.

CEO cash incentive compensation includes formula bonuses and discretionary bonuses. Payments of formula bonuses are based on objective performance measures such as earnings targets. Financial measures are the most widely used objective measures in determining CEO compensation [2]. Subjective evaluation and boards' decision to pay discretionary bonuses rely more on information gathered through direct supervision than on objective evaluation based on financial measures. Thus, we use whether a board grants a discretionary bonus to its CEO to measure a board's direct supervision.

The following excerpt from the 2010 proxy statement of MSCI Inc. illustrates the discretionary bonus payment: *"……the Committee invested considerable time to*

understand the external and internal factors affecting NEO (named executive officer) pay in 2010. . ..We did not establish a cash bonus program with pre-set performance goals that were required to be met. . .[so] the amounts of our annual cash bonuses to our named executive officers were discretionary." Similarly, the 2010 Proxy statement of Homeowners Choice, Inc. states the following: *"Our philosophy with respect to executive officer compensation is to establish moderate base salaries and place emphasis on discretionary bonus compensation, which is viewed by the Committee as very effective at correlating executive officer compensation with corporate performance and increases in shareholder value. We make our own judgments as to the performance of the executive officers and the level of their bonuses."*

3.1.2 Measures of accounting quality. One measure of accounting quality involves s whether a firm uses Big Four auditors. Because the Big Four auditors have larger clienteles than their smaller counterparts, significant future revenue from their clients is at stake if one of their audits fails. They thus have a greater incentive to provide high-quality audits than do small auditors (DeAngelo, 1981). Big auditors also spend heavily on auditor training programs and facilities. Empirical research has found that Big Four auditors provide higher quality audit services. Specifically, firms that utilize such auditors are associated with higher earnings response coefficients (Teoh & Wong, 1993), more accurate analysts' earnings forecasts (Behn, Jong-Hag, & Kang, 2008), higher quality and informativeness of discretionary accruals (Krishnan, 2003) and lower cost of capital (Khurana & Raman, 2004). *Big4* in this research is an indicator variable equaling 1 if firm i is audited by a Big Four auditor in year *t*, and 0 otherwise.

Predicated on extant work, another measure of accounting quality in our study is earnings' ability to predict future cash flows. Kim and Kross (2005) and Bandyopadhyay *et al.* (2010) interpret earnings relevance as the ability of current earnings to predict future operating cash flows. This is because SFAC No 2 define relevance as the extent to which accounting numbers reflect future cash flows. Because higher-quality earnings numbers should be more highly associated with future cash flows, scholars have used the relationship between current earnings and future cash flows to measure earnings informativeness and earnings quality (Atwood *et al.*, 2010). We follow Kim and Kross (2005) and Bandyopadhyay *et al.* (2010) to measure the earnings' ability to predict future cash flows of firm i in year *t*, which is computed as the incremental R^2 derived from the difference between the R^2 in a time-series regression of one-year-ahead cash flows on current earnings and cash flows, and the R^2 in the regression of one-year-ahead cash flows on current cash flows by firm (R^2 of regression 1 less R^2 of regression 2):

$$CFO_{T+1} = \alpha_0 + \alpha_1 CFO_T + \alpha_2 E_T + \varepsilon_T \quad (1)$$

$$CFO_{T+1} = \beta_0 + \beta_1 CFO_T + \eta_T \quad (2)$$

where CFO_T is net operating cash flow in year T, and E_T is earnings before extraordinary items in year T. Both *CFO* and *E* are deflated by total assets. To measure R^2, each regression requires 10 observations for the past 10 years before year *t* ($t-10 \leq T \leq t-1$).

The third accounting quality measure in this study is *abnormal accruals*. Large abnormal accruals are associated with low accounting quality (Dechow & Dichev, 2002; Jones, 1991). In the current investigation, signed abnormal accruals are used as a proxy of accounting quality, as large positive abnormal accruals indicate an increased likelihood of accrual management to inflate earnings. Hribar and Nichols (2007) suggest that employing absolute discretionary accruals as a measure of earnings management might bias tests in favor of a rejection of the null hypothesis of no earnings management. Signed discretionary accruals provide a clean test of whether managers' activities are managing earnings upward (McGuire, Omer, & Sharp, 2012).

Abnormal accruals are calculated using a modified Jones Model (Dechow & Sloan, 1995; Jones, 1991). Consistent with prior research, a firm performance variable is added to the accrual regression model as a control variable (Kothari, Leone, & Wasley, 2005; Bills, Swanquist, & Whited, 2016). Abnormal accruals are estimated with the following regression model by industry and year, with a minimum of 10 observations:

$$\begin{aligned} \mathrm{TTL\_ACCR_{it}}/\mathrm{ASSETS_{it-1}} = {} & \alpha_0 + \alpha_1(1/\mathrm{ASSETS_{it-1}}) \\ & + \alpha_2(\triangle\mathrm{REV_{it}} - \triangle\mathrm{REC_{it}})/\mathrm{ASSETS_{it-1}} \\ & + \alpha_3(\mathrm{PPE_{it}}/\mathrm{ASSETS}_{it-1}) + \alpha_4 NI_{it}/\mathrm{ASSETS}_{it-1} + \varepsilon_{it} \end{aligned} \quad (3)$$

TTL_ACCR_{it} (Total Accruals) = change in current assets – change in current liabilities – change in cash and short term investments + change in debts in current liabilities – depreciation; $ASSETS_{it-1}$ = Total Assets of firm i at the end of year t−1; $\triangle REV_{it}$ is the change in total revenue of firm i from year t−1 to year *t*. $\triangle REC_{it}$ is the change in total receivable of firm i from year t−1 to year *t*. PPE_{it} is the gross property, plant and equipment of firm i at the end of year *t*. NI_{it} is the net income of firm i in year *t*.

3.2 Control variables

We controlled for certain variables in our analyses. Selection of these variables was generally based on previous research. Because objective performance targets are determined at the beginning of the year, explicit contracts with objective performance measures cannot account for *ex ante* unforeseeable factors that would impact firm performance. CEOs will bear risks if boards use objective performance measures to evaluate them and determine their compensation (Harris & Raviv, 1979; Ke *et al.*, 1999). Discretionary bonuses based on subjective evaluation allow evaluators to exploit additional information about conditions that arise after the formal reward plan is set and to remove certain factors that executives cannot control, thus reducing the executive's risk (Baker, Jensen, & Murphy, 1988; Gibbs, Merchant, Van der Stede, & Vargus, 2004). Thus, Höppe and Moers (2011) find that industry volatility of return on assets and firm volatility, as measured by the standard deviation of residual stock return, are positively related to CEO discretionary compensation. However, Tsui (2013) shows that industry volatility is negatively related to CEO discretionary bonuses.

The board of directors can better subjectively evaluate the qualitative aspects of a CEO's performance as a CEO's tenure increases. Bushman, Indjejikian, and Smith (1996) found that CEO tenure is positively related to individual performance evaluation.

CEO/Chair Duality increases CEO power (Morse, Nanda, & Seru, 2011). Tsui (2013) discerns that CEO/chair duality is negatively and marginally related to discretionary bonuses. Höppe and Moers (2011) used a three-item factor score – including an indicator variable for CEO duality, the proportion of outside directors that the CEO appointed and the proportion of inside directors he/she appointed – to measure CEO power. They did not find a significant relationship between discretionary bonuses and CEO power.

We also control for research and development expenses and loss and size. Using compensation data of department managers in car dealerships, Gibbs *et al.* (2004) found that subjective bonuses paid to department managers are positively related to the level of long-term investments in intangibles. However, R&D activities can still be objectively assessed with measures such as patents received. Tsui (2013) does not find consistent, significant relationships between discretionary bonuses paid to executives and growth, as measured by the market-to-book ratio. Using data from car dealerships, Gibbs *et al.* (2004) find that if a department reports a loss, department managers are more likely to receive discretionary bonuses. However, discretionary bonuses constitute performance compensation. As such, then, CEOs will be less likely to receive performance compensation for poor firm performance

such as losses. Höppe and Moers (2011) and Tsui (2013) do not find any correlation between firm size and discretionary CEO compensation.

Creditors rely on accounting performance measures to evaluate a firm's ability to fulfill its debt obligations (Smith & Warner, 1979; Anderson, Mansi, & Reed, 2004; Bharath, Sunder, & Sunder, 2008; Li, Wang, & Wruck, 2020). By tying the CEO's pay to performance measures that creditors value, compensation plans based on accounting performance targets can better align the CEO's interests with those of creditors. Li *et al.* (2020) ascertain that CEO performance compensation based on accounting measures is negatively associated with the future cost of borrowing. Accounting and financial measures are the most frequently used objective performance measures. Thus, compared with firms having lower leverage, higher leveraged firms are more likely to measure CEO performance with objective measures and are less likely to evaluate CEO performance subjectively. We therefore expect that *Leverage* would be negatively related to *CEO Discretionary Bonus*.

Other control variables in the study include the book – market ratio, return on assets and annual stock return. Because both discretionary bonuses and formula bonuses are performance compensation, a firm's performance in the current year affects whether its CEO receives bonus payments. The regression model in this research includes the current year's return on assets and buy-and-hold annual returns.

3.3 Regression model

The logistic regression model (4) is used to test the relationship between CEO bonus type and accounting quality. The regression model controls for the current year's firm characteristics and performance, year and two-digit SIC code industry fixed effects.

$$\begin{aligned} Discretionary\,Bonus_{it}\,(Formula\,Bonus_{it}) = {} & \alpha_0 + \alpha_1 Big4_{it} + \alpha_2 Earning\,Predict\,CF_{it} \\ & + \alpha_3 Abnormal\,Accruals_{it} \\ & + \alpha_4 Industry\,Volatility_{it} + \alpha_5 Firm\,Volatility_{it} \\ & + \alpha_6 CEO\,Tenure_{it} + \alpha_7 CEO\,Duality_{it} \\ & + \alpha_8 R\&D\,to\,Sales_{it} + \alpha_9 B/M\,Ratio_{it} \\ & + \alpha_{10} Loss_{it} + \alpha_{11} Size_{it} + \alpha_{12} Leverage_{it} \\ & + \alpha_{13} Annual\,Return_{it} + \alpha_{14} ROA_{it} + \alpha_m Year_t \\ & + \alpha_n Industry_{it} + \varepsilon_{it} \end{aligned} \tag{4}$$

where the dependent variable includes two alternative indicator variables, *Discretionary Bonus*$_{it}$ and *Formula Bonus*$_{it}$, in two separate regressions. *Discretionary Bonus*$_{it}$ (*Formula Bonus*$_{it}$) is an indicator variable which equals 1 if the CEO of firm i receives a discretionary (formula) cash bonus in year *t*, and 0 otherwise. *Big4*$_{it}$ represents an indicator variable which equals 1, if firm i is audited by a Big Four auditor in year *t*, and 0 otherwise. *Earn Predict CF*$_{it}$ reflects the incremental R^2 derived from the difference between the R^2 in the time-series regression of one-year-ahead cash flows on current earnings and cash flows and the R^2 in the regression of one-year-ahead cash flows on current cash flows by firm. *Abnormal Accruals*$_{it}$ constitutes the abnormal accruals of firm i in year *t* estimated by a modified Jones model (Dechow & Sloan, 1995; Jones, 1991) with a performance control variable (Kothari *et al.*, 2005). Other variables are as defined in Appendix.

3.4 Sample

CEO compensation – including discretionary bonuses and formula bonuses – is obtained from ExecuComp. Code of Federal Regulation (CFR) § 229.402 changed the disclosure requirement of executive compensation. According to CFR § 229.402 and the SEC Final Rule Release No. 33-8732A "Executive Compensation and Related Person Disclosure" of 2006, cash incentive compensation based on a pre-established performance target is reported as "non-equity incentive plan compensation"; a discretionary bonus is reported as "bonus", effective for proxy statements filed for fiscal years ending on or after December 15, 2006. Financial data are obtained from Compustat. Stock return data were gleaned from CRSP. CEO tenure was calculated based on the information from ExecuComp. To avoid losing observations after merging with another dataset, CEO chair duality information is also obtained from data in ExecuComp.

Shown in Table 1 Panel A is the sample selection of CEO bonuses from 2007 to 2016 [3]. After merging the dataset of ExecuComp and CompuStat and removing partial year observations and observations with no CEO cash compensation [4], 19,840 observations remain. Of those, 3,696 observations are removed from the sample because they are a CEO's first year or last year in office [5] or because the observations omit information necessary to determine CEO tenure or CEO duality. The cash bonus the CEO receives during his/her first year or last year in office might include non-performance payments such as sign-on bonuses. After removing additional observations missing auditor, stock return, or financial information, the final sample comprises 9,510 observations. In 17.3% of the observations, the CEO is awarded a discretionary bonus.

As depicted in Panel B, CEOs receive only discretionary bonuses in 9.3% of the observations, obtain solely formula bonuses in 70% of the observations, and garner both discretionary bonuses and formula bonuses in 8.1% of the observations. The year distribution reveals that the percentage of firms that paid discretionary bonuses has been declining since public firms were required to hold a non-binding advisory vote on executive compensation among shareholders – generally known as "say-on-pay" votes. This indicates that shareholders without board representation have less access to management and thus are less likely to monitor CEOs through direct supervision.

4. Results

4.1 Descriptive statistics

As shown in Table 2, among CEOs whose cash bonuses only include discretionary bonuses, discretionary bonuses represent 45.9% of CEO cash compensation and 26.1% of CEO total compensation. Presented in Table 3 are the descriptive statistics, and reported in Table 4 are the Pearson and Spearman correlations of the variables included in the main regressions. *Discretionary Bonuses* and *Formula Bonuses* are negatively correlated, indicating that firms view discretionary bonuses as substitute compensation arrangements rather than supplements to formula bonuses. Because the majority of formula bonuses are based on financial performance targets, the negative correlation between *Discretionary Bonuses* and *Formula Bonuses* indicates that boards regard monitoring through direct supervision as a substitute for monitoring through accounting. *Big4* is negatively correlated with *Discretionary Bonus* and positively correlated with *Formula Bonus*. *Abnormal Accruals* is positively correlated with *Discretionary Bonus*.

4.2 Logit regressions

Table 5 presents the results of the logit regression that examines whether accounting quality is negatively associated with the board's use of direct supervision – proxied by CEO discretionary bonuses – to mitigate agency conflicts. In the regression model of *Discretionary Bonus*, a significant and negative coefficient for *Big4* (p-value = 0.023) and for *Earning*

Table 1. Sample selection and sample distribution

Panel A: Sample selection

Observations in COMPUSTAT from 2007 to 2016	112,987
Remove partial year observations	(8,241)
Observations missing cash compensation	(84,906)
CEOs' first and last year in office and observations missing CEO tenure	(3,696)
Observations missing auditor information	(369)
Observations missing stock return information	(1,451)
Observations missing financial or industry information	(4,814)
Final sample	9,510

Panel B: Sample distribution
Firm-year observation analysis

	# of Obs	Pct
Discretionary bonus payments only	882	9.3%
Formula bonus payments only	6,659	70.0%
Discretionary bonus and formula bonus payments in the same year	767	8.1%
Neither discretionary bonus nor formula bonus payments in a year	1,202	12.6%
Total observations	9,510	100.0%
Discretionary bonus payments	1,649	17.3%
Formula bonus payments	7,426	78.1%

Year distribution

Year	Observations	Discretionary bonus	Pct	Formula bonus	Pct
2007	913	204	22.3%	705	77.2%
2008	920	188	20.4%	647	70.3%
2009	1,007	185	18.4%	695	69.0%
2010	1,005	211	21.0%	798	79.4%
2011	979	176	18.0%	772	78.9%
2012	973	182	18.7%	773	79.4%
2013	962	145	15.1%	795	82.6%
2014	956	138	14.4%	785	82.1%
2015	894	123	13.8%	725	81.1%
2016	901	97	10.8%	731	81.1%
	9,510	1,649		7,426	

Predict CF (p-value = 0.019) is obtained, as well as a significant and positive coefficient for *Abnormal Accruals* (p-value <0.001). In the regression model of *Formula Bonus*, a significant and positive coefficient for *Big4* (p-value <0.001) and for *Earning Predict CF* (p-value = 0.007) emerges, as well as a significant and negative coefficient for *Abnormal Accruals* (p-value = 0.071). The foregoing results infer that boards are more likely to use direct supervision and subjective evaluation to alleviate agency conflicts and to pay discretionary bonuses if their firms have low accounting quality. The results are robust when data are winsorized, hence indicating that extreme values do not drive the aforementioned findings.

In the regression models of discretionary bonuses, the coefficient of firm-specific volatility measured by *Return Volatility* is significant and positive. The results are consistent with prior research that has found that firms use discretionary bonuses to remove firm-specific performance volatility. However, firms can use relative performance evaluations instead of

Table 2. Summary of discretionary bonuses and formula bonuses

	# of Obs	Median	Mean	% of cash comp	% of total comp
Observations of CEOs receiving only discretionary bonuses in a year					
Discretionary Bonuses	882	573,088	1,534,940	45.9%	26.1%
Total Compensation	882	2,575,510	5,377,870		
Observations of CEOs receiving only formula bonuses in a year					
Formula Bonuses	6,659	1,007,180	1,523,460	53.9%	25.6%
Total Compensation	6,659	4,610,570	6,197,090		
Observations of CEOs receiving both discretionary bonuses and formula bonuses in the same year					
Discretionary Bonuses	767	218,750	490,754	15.2%	8.4%
Formula Bonuses	767	840,000	1,456,880	43.0%	23.3%
Total Compensation	767	4,276,940	6,109,210		

Note(s): *% of Cash Comp* column presents the discretionary (formula) bonuses as a percentage of CEO cash compensation. *% of Total Comp* column presents the discretionary (formula) bonuses as a percentage of CEO total compensation. It is the average ratio of a CEO's bonus to the CEO's total compensation. Cash compensation includes salary, discretionary bonuses, and formula bonuses. Total Compensation includes cash compensation, the fair value of stock awards, and option awards

Table 3. Descriptive statistics

Variable	*N*	Mean	Q1	Median	Q3	Std dev
Discretionary Bonus Weight	9,510	0.055	0.000	0.000	0.000	0.157
Formula Bonus Weight	9,510	0.412	0.170	0.489	0.619	0.267
Discretionary Bonus	9,510	0.173	0.000	0.000	0.000	0.379
Formula Bonus	9,510	0.781	1.000	1.000	1.000	0.414
Big4	9,510	0.900	1.000	1.000	1.000	0.300
Earning Predict CF	9,510	0.146	0.018	0.080	0.218	0.170
Abnormal Accruals	9,510	0.001	−0.022	0.000	0.022	0.049
ROA Volatility	9,510	0.024	0.011	0.020	0.031	0.022
Return Volatility	9,510	0.092	0.058	0.081	0.112	0.050
CEO Tenure	9,510	7.795	2.496	5.608	10.501	7.518
CEO Duality	9,510	0.464	0.000	0.000	1.000	0.499
R&D to Sales	9,510	0.207	0.000	0.004	0.058	6.392
B/M Ratio	9,510	0.488	0.258	0.429	0.661	0.887
Loss	9,510	0.172	0.000	0.000	0.000	0.377
Size	9,510	7.668	6.531	7.593	8.741	1.683
Leverage	9,510	0.201	0.022	0.180	0.304	0.195
Annual Return	9,510	0.158	−0.114	0.109	0.330	0.590
ROA	9,510	0.044	0.020	0.052	0.091	0.114

Note(s): Presented in this table are the number of observations, mean, first quantile, median, third quantile, and standard deviation

discretion bonuses to elide industry volatility. The coefficient of the industry volatility measured by *ROA Volatility* is insignificant.

Findings reveal that *CEO Tenure* is positively related to discretionary bonuses. This result infers that boards can better subjectively evaluate the performance of long-tenured CEOs. Also, results show that *Leverage* is negatively related to *Discretionary Bonus* and positively related to *Formula Bonus*. Firms that rely more heavily on debt financing thus evidently evaluate CEO performance with accounting performance targets that creditors favor. Accordingly, more highly leveraged firms are apparently more likely to use objective measures to evaluate CEO performance.

Table 4. Correlation table

	Discret bonus	Formula bonus	Big4	Earning predict CF	Abnorm accrual	ROA volatility	Return volatility	CEO tenure	CEO duality	R&D to sales	B/M ratio	Loss	Size	Leverage	ROA
Discret Bonus		*−0.350*	*−0.060*	−0.011	*0.042*	*0.048*	*0.098*	*0.088*	0.007	*−0.021*	*0.022*	−0.008	*−0.055*	*−0.051*	*0.040*
Formula Bonus	*−0.350*		*0.151*	0.001	*−0.032*	*−0.038*	*−0.167*	*−0.095*	0.014	*−0.024*	*−0.107*	*−0.212*	*0.241*	*0.115*	*0.156*
Big4	*−0.060*	*0.151*		−0.014	−0.008	*−0.071*	*−0.212*	*−0.091*	*0.043*	*−0.083*	*−0.050*	*−0.085*	*0.328*	*0.203*	0.019
Earn Predict CF	−0.016	0.012	−0.017		0.019	*0.026*	0.019	0.004	*−0.022*	−0.010	*0.040*	0.003	*−0.035*	*−0.046*	0.006
Abnorm Accrual	*0.046*	−0.019	−0.014	0.017		−0.008	0.011	0.001	0.002	*−0.057*	*0.043*	−0.019	*−0.031*	*0.026*	−0.003
ROA Volatility	*0.022*	−0.009	*−0.054*	*0.024*	−0.008		*0.271*	*0.056*	*−0.034*	*0.284*	*−0.039*	*0.105*	*−0.113*	*−0.180*	*0.076*
Return Volatility	*0.100*	*−0.158*	*−0.195*	*0.033*	0.011	*0.183*		*0.044*	*−0.142*	*0.117*	*0.170*	*0.302*	*−0.602*	*−0.207*	*−0.212*
CEO Tenure	*0.115*	*−0.136*	*−0.117*	*0.024*	−0.001	*0.033*	*0.031*		*0.318*	−0.003	*−0.024*	*−0.063*	*−0.068*	*−0.061*	*0.064*
CEO Duality	0.007	0.014	*0.043*	−0.016	−0.015	*−0.020*	*−0.109*	*0.290*		*−0.073*	*−0.022*	*−0.090*	*0.148*	*0.044*	*0.059*
R&D to Sales	*0.049*	*−0.042*	*−0.067*	0.004	0.016	*0.037*	*0.098*	0.011	0.009		*−0.172*	*0.103*	*−0.041*	*−0.290*	*0.035*
B/M Ratio	*0.024*	*−0.041*	*−0.037*	0.007	−0.012	−0.014	0.013	0.008	−0.013	−0.005		*0.192*	*−0.371*	*−0.099*	*−0.448*
Loss	−0.008	*−0.212*	*−0.085*	0.007	*−0.026*	*0.087*	*0.278*	*−0.029*	*−0.090*	*0.054*	*0.072*		*−0.328*	*0.042*	*−0.653*
Size	*−0.047*	*0.233*	*0.327*	*−0.045*	*−0.027*	*−0.069*	*−0.521*	*−0.094*	*0.154*	*−0.042*	*−0.122*	*−0.345*		*0.256*	*0.328*
Leverage	*−0.034*	*0.072*	*0.157*	*−0.054*	*0.038*	*−0.089*	*−0.052*	*−0.065*	0.004	−0.016	*−0.094*	*0.078*	*0.148*		*−0.220*
ROA	*0.027*	*0.171*	*0.058*	−0.010	−0.004	−0.014	*−0.213*	*0.029*	*0.053*	*−0.143*	*−0.059*	*−0.644*	*0.340*	*−0.135*	

Note(s): The numbers below (above) the diagonal are Pearson (Spearman) correlations. Italic figures are statistically significant at the 0.05 (two-tailed) level

Table 5. Regression analysis of accounting quality

	Discretionary Bonus (1)	*Formula Bonus* (2)
Intercept	−2.329***	0.356
	(<0.001)	(0.224)
$Big4_{it}$	−0.214**	0.475***
	(0.023)	(<0.001)
$Earning\ Predict\ CF_{it}$	−0.407**	0.441***
	(0.019)	(0.007)
$Abnormal\ Accruals_{it}$	2.493***	−0.93*
	(<0.001)	(0.071)
$ROA\ Volatility_{it}$	−2.226	4.507***
	(0.153)	(0.003)
$Return\ Volatility_{it}$	3.066***	−1.535**
	(<0.001)	(0.02)
$CEO\ Tenure_{it}$	0.037***	−0.043***
	(<0.001)	(<0.001)
$CEO\ Duality_{it}$	−0.147**	0.121**
	(0.018)	(0.040)
$R\&D\ to\ Sales_{it}$	0.095***	−0.019
	(0.004)	(0.260)
$B/M\ Ratio_{it}$	0.065	0.008
	(0.105)	(0.773)
$Loss_{it}$	−0.146	−0.738***
	(0.158)	(<0.001)
$Size_{it}$	−0.026	0.177***
	(0.257)	(<0.001)
$Leverage_{it}$	−0.623***	0.806***
	(<0.001)	(<0.001)
$Annual\ Return_{it}$	0.165***	0.300***
	(0.001)	(<0.001)
ROA_{it}	1.108***	0.492
	(0.002)	(0.103)
Year indicators	Yes	Yes
Industry indicators	Yes	Yes
Number of observations	9,510	9,510
Pseudo R^2	0.080	0.123

Note(s): Presented in this table are the results of logistic regression of *Discretionary (Formula) Bonus* variables on the test variables for accounting quality. The regressions control for year and 2-digit SIC code industry effects. All variables are defined in Appendix. *, **, and *** indicate that the estimated coefficients are statistically significant at 0.10, 0.05, and 0.01, respectively. *P*-values in brackets are from Wald tests

Analyses further indicate that *Discretionary Bonus* is negatively related to *CEO Duality* and positively associated with *R&D to Sales*. The discretionary bonus and the formula bonus are both performance compensations. Regression, moreover, demonstrates that *Discretionary Bonus* and *Formula Bonus* are both positively related to *Annual Return* and *ROA*. No significant relationship is found, though, between *Discretionary Bonus* and *Loss* or *Size* [6].

5. Robustness tests and additional analysis

5.1 OLS regression and tobit regression

Table 6 reports the regression results using a continuous dependent variable, *Discretionary Bonus Weight*, to examine whether accounting quality is negatively associated with the board's tendency to use direct supervision – proxied by the CEO's discretionary bonus weight – to alleviate agency conflicts. The dependent variables represent the weight of a CEO's

Table 6. Regression analysis of discretionary bonus weight

	Discretionary Bonus Weight (1)	(2)
Intercept	−0.016	−0.747***
	(0.349)	(<0.001)
$Big4_{it}$	−0.027***	−0.096***
	(<0.001)	(<0.001)
Earning Predict CF_{it}	−0.027***	−0.141***
	(0.003)	(0.004)
Abnormal $Accruals_{it}$	0.121***	0.628***
	(<0.001)	(<0.001)
ROA $Volatility_{it}$	−0.186**	−0.891**
	(0.018)	(0.045)
Return $Volatility_{it}$	0.235***	0.982***
	(<0.001)	(<0.001)
CEO $Tenure_{it}$	0.002***	0.011***
	(<0.001)	(<0.001)
CEO $Duality_{it}$	−0.010***	−0.045***
	(0.002)	(0.009)
R&D to $Sales_{it}$	0.001*	0.002**
	(0.030)	(0.011)
B/M $Ratio_{it}$	0.002	0.016
	(0.179)	(0.132)
$Loss_{it}$	0.005	−0.024
	(0.391)	(0.400)
$Size_{it}$	0.004***	0.004
	(<0.001)	(0.534)
$Leverage_{it}$	−0.013	−0.144***
	(0.162)	(0.002)
Annual $Return_{it}$	0.009***	0.044***
	(<0.001)	(<0.001)
ROA_{it}	0.074***	0.284***
	(<0.001)	(0.002)
Year indicators	Yes	Yes
Industry indicators	Yes	Yes
Number of observations	9,510	9,510
R^2	0.088	0.095

Note(s): Column 1 of this table presents the results of ordinary least square regression of *Discretionary (Formula) Bonus Weight* on the test variables of accounting quality. Column 2 presents the result of Tobit regression model, in which the dependent variable, D*iscretionary Bonus Weight*, is censored below zero. The regressions control for year and 2-digit SIC code industry effects. All variables are defined in Appendix. *, **, and *** indicate that the estimated coefficients are statistically significant at 0.10, 0.05, and 0.01 level, respectively. *P*-values in brackets are from two-tailed *t*-tests

discretionary (formula) bonus relative to the entire cash compensation [7]. The results of OLS regression are consistent with logit regressions in Table 5. In the regression models of *Discretionary Bonus Weight*, the coefficients for *Big4* and *Earning Predict CF* are negative, and the coefficient for *Abnormal Accruals* is positive. Using continuous dependent variables, a negative relationship between discretionary bonuses and industry volatility measured by *ROA Volatility* emerges. This finding is consistent with the results of Tsui (2013), who also found a negative association between discretionary bonuses and industry volatility.

The amount of discretionary bonus or formula bonus cannot be negative. For robustness, Column 2 of Table 6 presents Tobit regression analysis with the dependent variables left-censored at 0. The Tobit models produce consistent results. Firms with high accounting quality are less likely to grant discretionary bonuses to CEOs.

5.2 PSM sample

Firm performance might affect whether a CEO receives discretionary bonuses or formula bonuses. Ederhof (2010) finds that firms with very low or very high performance are more likely to pay discretionary bonuses. CEOs with poor performance are less likely to receive bonuses; other factors might also be related to a firm's use of discretionary bonuses. To make the discretionary bonus observations more comparable with formula bonus observations, this study employs PSM to match observations of CEOs receiving only discretionary bonuses with observations of CEOs receiving only formula cash bonuses.

In the first step of PSM, the probability that a CEO receives a discretionary bonus is predicted with logit regression (5). In the second step, observations in which CEOs are granted only discretionary bonuses were matched with observations in which CEOs are awarded only formula bonuses based on the closeness of predicted value calculated in the first step. The matching criteria are set at a caliper distance of 0.01, with a one-to-one match and no replacement.

$$\begin{aligned} Discretionary\ Bonus_{it} = {} & \alpha_0 + \alpha_1 Industry\ Volatility_{it} + \alpha_2 Firm\ Volatility_{it} + \alpha_3 CEO\ Tenure_{it} \\ & + \alpha_4 CEO\ Duality_{it} + \alpha_5 R\&D\ to\ Sales_{it} + \alpha_6 B/M\ Ratio_{it} \\ & + \alpha_7 Loss_{it} + \alpha_8 Size_{it} + \alpha_9 Leverage_{it} + \alpha_{10} Annual\ Return_{it} \\ & + \alpha_{11} ROA_{it} + \alpha_m Year_t + \alpha_n Industry_{it} + \varepsilon_{it} \end{aligned} \tag{5}$$

After PSM, the sample included 814 pairs of matched observations. Shown in Table 7 Panel B are the means of the variables used as the matching criteria. Values in Columns M1-M2 are the differences in the means between the discretionary bonus observations and formula bonus observations. The *p*-value is based on a two-tail *T*-test examining whether the values in Column M1-M2 are different from zero. The statistics in Panel B show no significant difference between the discretionary bonus observations and formula bonus observations vis-a-vis the matching criteria. The regression analysis of the PSM matched sample in Panel A reveals that boards of firms with low accounting quality are more likely to evaluate CEOs subjectively and award discretionary bonuses.

5.3 ITVC

We also utilize the ITVC analysis from Frank (2000) to further alleviate the concern regarding endogeneity that the observed relationship between Accounting Quality and Discretionary Bonus might be caused by unobserved confounding variables. An unobserved variable needs to be correlated with both the dependent variable (y) and research variable (x) after controlling for the other variables to affect the coefficient of the variable x. The ITCV is the lowest product of the partial correlation between the dependent variable (y) and the confounding variable and the partial correlation between the research variable (x) and the confounding variable that makes the coefficient statistically insignificant.

The ITCV for *Big4* reported in Table 8 is −0.0462. An omitted variable would have to be partially correlated with 0.215 with *Discretionary Bonus Weight* and partially correlated at −0.215 with *Big4* to make the coefficient of *Big4* insignificant. The ITCV for *Earning Predict CF* is −0.0084, thus indicating that an omitted variable would have to be partially correlated at 0.092 with the *Discretionary Bonus Weight* and partially correlated at −0.092 with *Earning Predict CF* to make the coefficient of *Earning Predict CF* insignificant. The ITCV for *Abnormal Accruals* is 0.0135, indicating that an omitted variable would have to be partially correlated at 0.116 with the *Discretionary Bonus Weight* and partially correlated at 0.116 wth *Abnormal Accruals* to make the coefficient of *Abnormal Accruals* insignificant.

Table 7. Propensity score matched sample

Panel A: Regression analysis

	Discretionary Bonus	*Discretionary Bonus Weight*
Intercept	−0.056	0.453
	(0.913)	(0.105)
$Big4_{it}$	−0.589***	−0.101***
	(<0.001)	(<0.001)
Earning Predict CF_{it}	−0.642**	−0.077*
	(0.048)	(0.080)
$Abnormal\ Accruals_{it}$	2.106**	0.253*
	(0.040)	(0.061)
$ROA\ Volatility_{it}$	3.785	0.309
	(0.231)	(0.467)
$Return\ Volatility_{it}$	0.479	0.12
	(0.67)	(0.429)
$CEO\ Tenure_{it}$	−0.010*	−0.002***
	(0.092)	(0.010)
$CEO\ Duality_{it}$	0.056	0.011
	(0.622)	(0.461)
$R\&D\ to\ Sales_{it}$	−0.067	0.02
	(0.777)	(0.525)
$B/M\ Ratio_{it}$	−0.031	−0.011
	(0.688)	(0.291)
$Loss_{it}$	0.144	0.029
	(0.433)	(0.243)
$Size_{it}$	0.066	0.031***
	(0.104)	(<0.001)
$Leverage_{it}$	−0.13	0.058
	(0.672)	(0.159)
$Annual\ Return_{it}$	−0.079	0.000
	(0.237)	(0.972)
ROA_{it}	0.313	0.149
	(0.616)	(0.076)
Year indicators	Yes	Yes
Industry indicators	Yes	Yes
Number of observations	1,628	1,628
R^2 or Pseudo R^2	0.020	0.085

Panel B: Comparison of observations in propensity score matched sample

	Discretionary bonus		*Formula bonus*			
	N	Mean (M1)	*N*	Mean (M2)	M1-M2	*p*-value
ROA Volatility	814	0.025	814	0.024	0.001	0.161
Return Volatility	814	0.105	814	0.104	0.001	0.646
CEO Tenure	814	10.279	814	10.861	−0.581	0.206
CEO Duality	814	0.458	814	0.449	0.009	0.728
R&D to Sales	814	0.074	814	0.079	−0.005	0.704
B/M Ratio	814	0.503	814	0.518	−0.015	0.671

(*continued*)

Table 7. Continued

Panel B: Comparison of observations in propensity score matched sample

	Discretionary bonus		*Formula bonus*			
	N	Mean (M1)	*N*	Mean (M2)	M1-M2	*p*-value
Loss	814	0.186	814	0.182	0.004	0.848
Size	814	7.410	814	7.346	0.064	0.444
Leverage	814	0.178	814	0.179	−0.001	0.898
Annual Return	814	0.208	814	0.228	−0.020	0.664
ROA	814	0.051	814	0.047	0.005	0.450

Note(s): Presented in Table 7 Panel A are the findings for the regression analysis of the propensity score matched sample. Firm-year observations of CEOs who only receive discretionary bonuses in a year are matched with firm-year observations of CEOs who only receive formula bonuses in a year based on *ROA Volatility, Return Volatility, CEO Tenure, CEO Duality, R&D to Sales, B/M Ratio, Loss, Size, Leverage, Annual Return, ROA*, Year, and Industry. Shown in Column 1 are the results of logit regression; depicted in Column 2 are results of OLS regressions. *, **, and *** indicate that the estimated coefficients are statistically significant at 0.10, 0.05, and 0.01 level, respectively. *P*-values in brackets are from Wald tests of the logit regression and two-tailed *t*-tests of OLS regressions. The regressions control for year and 2-digit SIC code industry effects. All variables are defined in Appendix. Presented in Panel B is the comparison of observations in the propensity score matched sample. Reported in Column M1-M2 is the mean difference between Discretionary Bonus observations and Formula Bonus observations. The *p*-value is based on a two-tailed *t*-test

Following prior research (Larcker a& Rusticus, 2010; Busenbark, Yoon, Gamache, & Withers, 2022; Chapman, Miller, & White, 2019; Donelson, Glenn, & Yust, 2022), we compare the ITCV for *Big4*, *Earning Predict CF* and *Abnormal Accruals* with the impact factors of control variables to evaluate the robustness of the findings, because the potential missing variables cannot be observed, and their impact factors cannot be measured. The ITCV for *Big4* and *Earning Predict CF* is negative. Including a control variable with a positive impact factor in the regression will strengthen the coefficients for *Big4* and *Earning Predict CF*, and including a control variable with a negative impact factor will weaken the coefficients. The variable with the largest adverse impact on the coefficient for *Big4* is *CEO Tenure*, with an impact factor of −0.0115. The ITCV for *Big4* was −0.0462. The minimum impact of missing variable needs to be 4.02 times larger than the most impactful control variable to make the coefficient for *Big4* insignificant. The variable with the largest adverse impact on the coefficient of *Earning Predict CF* is *Size*, with an impact factor of −0.0005. The ITCV for *Earning Predict CF* is −0.0084. The minimum impact of missing variable needs to be 16.8 times larger than the most impactful control variable to make the coefficient for *Earning Predict CF* insignificant. Because the ITCV for *Abnormal Accruals* is positive. Including a control variable with a negative impact factor in the regression will strengthen the coefficient of *Abnormal Accruals*, and including a control variable with a positive impact factor will weaken the coefficient. The variable with the largest adverse impact on the coefficient of *Abnormal Accruals* is *ROA Volatility*, with an impact factor of 0.0003. The ITCV for *Abnormal Accruals* was 0.0135. The minimum impact of missing variable needs to be 45 times larger than the most impactful control variable to make the coefficient for *Abnormal Accruals* insignificant.

Considering that the selection of control variables is based on prior research, the possibility of missing confounding variables that are 4.02 times, 16.8 times and 45 times more impactful than any of the included control variables is relatively low. Based on ITCV analysis, the possibility of missing a confounding variable that would invalidate the regression results is relatively low, although the regression model cannot control for all possible confounding variables [8].

Table 8. Impact threshold of confounding variable

	Impact on coefficient for		
	Big4 (1)	*Earning Predict CF* (2)	*Abnormal Accruals* (3)
ROA Volatility	0.0001	−0.0004	0.0003
Return Volatility	−0.0025	0.0001	0
CEO Tenure	−0.0115	0.0028	0.0001
CEO Duality	−0.0002	0.0005	0
R&D to Sales	−0.0016	0	0.0003
B/M Ratio	0.0002	−0.0001	0.0003
Loss	−0.0004	0	−0.001
Size	0.0028	−0.0005	−0.0006
Leverage	−0.003	0.001	−0.0011
Annual Return	−0.001	0.0001	−0.0003
ROA	−0.0029	−0.0002	−0.0006
Largest impact among control variables that adversely affect the significance of the accounting quality variables' coefficients	−0.0115	−0.0005	0.0003
Impact threshold of confounding variable	−0.0462	−0.0084	0.0135
Ratio of ITCV to largest impact of control variables	4.02	16.80	45.00

Note(s): Presented in Table 8 are the results for the ITVC analysis. Presented in Column 1, 2, and 3 is the impact of each control variable on the coefficients of accounting quality variables (i.e. *Big 1, Earning Predict CF, and Abnormal Accruals*), which is the product of the partial correlation between that control variable and the dependent variable (i.e. *Discretionary Bonus Weight*) and the partial correlation between that control variable and one of the accounting quality variables. *Big4* and *Earning Predict CF* have negative coefficients in regressions of *Discretionary Bonus Weight*, and a control variable with a positive (negative) impact factor will make the coefficients more (less) negative. *Abnormal Accruals* has a positive coefficient in regressions *of Discretionary Bonus Weight*, and a control variable with a negative (positive) impact factor in the regression will make the coefficient more (less) positive. ITCV is the lowest product of the partial correlation between the dependent variable and the unobserved confounding variable and the partial correlation between the accounting quality variable and the confounding variable that makes the coefficient statistically insignificant. Ratio of ITCV to largest impact of control variables indicates how impactful an unobserved confounding variable needs to be to make the coefficients of accounting quality variables insignificant. For example, the impact of an unobserved confounding variable needs to be at least 4.02 times larger than the most impactful control variable to make the coefficient of *Big4* insignificant

5.4 Clustering

Because firms tend to change auditors infrequently, the observations of Big Four auditors could be correlated with a firm, resulting in clustered data. The observations of abnormal accruals, earnings' ability to predict future cash flows, discretionary bonuses, or formula bonuses might thus have less variation within a firm than between firms. Following prior research (Hilary & Hui, 2009), the regressions are clustered at the firm level to address the concern of within-firm correlation. The regression analysis using cluster robust standard errors revealed consistent results (Table 9). In particular, firms with low accounting quality are more likely to grant CEOs discretionary bonuses.

5.5 Firm and year fixed effects

CEO contract arrangement is relatively persistent, and prior research tends to rely on cross-section variation instead of over-time variation to analyze subjectivity in CEO compensation (Curtis, Li, & Patrick, 2021). Controlling for firm fixed effects will eliminate the cross-sectional variation. Prior research tends to not utilize firm fixed effect regression in examining discretionary bonuses (Höppe & Moers, 2011). Table 10 of this study reveals that after controlling for firm fixed effects, except for the accounting quality and *CEO Tenure*, the

Table 9. Robust regression analysis of clustering observations by firm

	Discretionary Bonus (1)	*Discretionary Bonus Weight* (2)
Intercept	−2.321***	0.079
	(0.010)	(0.423)
$Big4_{it}$	−0.51**	−0.041**
	(0.038)	(0.029)
Earning Predict CF_{it}	−0.845**	−0.029*
	(0.023)	(0.086)
Abnormal $Accruals_{it}$	2.187***	0.123**
	(0.007)	(0.014)
ROA $Volatility_{it}$	−3.769	−0.165
	(0.188)	(0.126)
Return $Volatility_{it}$	3.655**	0.254***
	(0.021)	(0.006)
CEO $Tenure_{it}$	0.064***	0.003***
	(<0.001)	(<0.001)
CEO $Duality_{it}$	−0.3*	−0.015*
	(0.070)	(0.054)
R&D to $Sales_{it}$	0.067**	0.000***
	(0.016)	(0.001)
B/M $Ratio_{it}$	0.035	0.004
	(0.576)	(0.531)
$Loss_{it}$	0.295	0.015
	(0.108)	(0.147)
$Size_{it}$	−0.07	0.004
	(0.328)	(0.331)
$Leverage_{it}$	−1.012**	−0.021
	(0.037)	(0.325)
Annual $Return_{it}$	0.075	0.006
	(0.104)	(0.079)
ROA_{it}	0.849	0.085*
	(0.244)	(0.084)
Year indicators	Yes	Yes
Industry indicators	Yes	Yes
Number of observations	7,541	7,541
R^2 or Pseudo R^2	0.152	0.100

Note(s): Presented in Table 9 are the findings for regression analysis using cluster-robust standard errors. The regressions are clustered by firm. Presented in Column 1 are the results of logit regressions; presented in Column 2 are the results for OLS regressions. *, **, and *** indicate that the estimated coefficients are statistically significant at the 0.1, 0.05, and 0.01 level, respectively. *P*-values in brackets are from Wald tests of logit regressions and two-tailed *t*-tests of OLS regressions. The regressions control for year and 2-digit SIC code industry effects. All variables are defined in Appendix

coefficients of all other independent variables are no longer significant, including the variables that are found to be correlated with discretionary bonuses in prior research. Nevertheless, we control for firm fixed effects for robustness. Because adding firm fixed effects in logit regressions might cause quasi-complete separation resulting in unreliable coefficient estimates, we regress *Discretionary Bonus* on accounting quality variables after controlling for firm and year fixed effects in a linear probability model.

As shown in Table 10, accounting quality is measured using two composite variables: *Accounting Quality1* and *Accounting Quality2*. *Accounting Quality1* is the average of three standardized variables, including standardized *Big4*, standardized *Earning Predict CF*, and the opposite of the standardized *Abnormal Accruals* [9]. The Big Four auditors provide high-

Table 10. Firm fixed effect

	Discretionary Bonus (1)	*Discretionary Bonus* (2)
Intercept	0.037	0.072
	(0.665)	(0.408)
Accounting Quality1$_{it}$	−0.018**	
	(0.012)	
Accounting Quality2$_{it}$		−0.066***
		(0.004)
ROA Volatility$_{it}$	−0.207	−0.204
	(0.246)	(0.252)
Return Volatility$_{it}$	0.118	0.114
	(0.299)	(0.313)
CEO Tenure$_{it}$	0.003**	0.003**
	(0.040)	(0.037)
CEO Duality$_{it}$	−0.008	−0.008
	(0.566)	(0.546)
R&D to Sales$_{it}$	0.000	0.000
	(0.769)	(0.648)
B/M Ratio$_{it}$	0.004	0.004
	(0.478)	(0.471)
Loss$_{it}$	0.012	0.012
	(0.321)	(0.317)
Size$_{it}$	−0.001	−0.001
	(0.958)	(0.935)
Leverage$_{it}$	0.051	0.052
	(0.176)	(0.169)
Annual Return$_{it}$	0.005	0.005
	(0.392)	(0.364)
ROA$_{it}$	0.009	0.011
	(0.872)	(0.855)
Year Indicators	Yes	Yes
Firm fixed effect	Yes	Yes
Number of observations	7,541	7,541
R^2	0.044	0.042

Note(s): Presented in Table 10 are the results for linear probability model controlling year and firm fixed effects using cluster-robust standard errors. The regressions are clustered by firm. In Column 1, the independent variable *Accounting Quality1* is a composite measure, which is the average of standardized *Big4*, standardized *Earning Predict CF*, and the opposite of standardized *Abnormal Accruals*. In Column 2, *Accounting Quality2* is also a composite measure, which is the average of the three ranks scaled by the number of observations: the rank in *Big4*, the rank in *Earning Predict CF*, and the rank in *Abnormal Accruals* (in decreasing order). The sample includes observations in which CEOs received either a discretionary bonus or a formula bonus but not both. The regressions control for year and firm fixed effects. All variables are defined in Appendix. *, **, and *** indicate that the estimated coefficients are statistically significant at the 0.10, 0.05, and 0.01% level, respectively. *P*-values in brackets are from two-tailed *t*-tests

quality audits and a more significant relation between current earnings and future cash flows indicates higher accounting quality. A larger value in *Big4* or *Earning Predict CF* is associated with higher accounting quality, and a larger value in *Abnormal Accruals* is associated with lower accounting quality. Thus, the opposite of the standardized *Abnormal Accruals* is used to calculate the composite variable *Accounting Quality1*. Similar to prior research, we employ the unweighted average of individual standardized variables to construct the composite variable (Healy, Serafeim, Srinivasan, & Yu, 2014; Lara, Osma, & Penalva, 2009; Davila & Penalva, 2006).

The second composite measure of accounting quality, *Accounting Quality2*, is the average rank of the three variables *Big4*, *Earning Predict CF* and *Abnormal Accruals*. To calculate *Accounting Quality2*, the observed values of *Big4*, *Earning Predict CF* and *Abnormal Accruals* are ranked separately in the first step. If several observations have the same value, those observations are assigned the mean of the corresponding rank. Because a larger value in *Abnormal Accruals* is associated with lower accounting quality, *Abnormal Accruals* is ranked in descending order. After the observations are ranked by *Big4*, *Earning Predict CF* and *Abnormal Accruals*, alternatively, each observation has three separate ranks. *Accounting Quality2* is the average of the three ranks scaled by the number of observations.

After controlling for firm and year fixed effects, *Accounting Qualty1* and *Accounting Quality2* were found to be negatively related to *Discretionary Bonuses*. The regressions controlling for firm and year fixed effects produce consistent results. Specifically, firms with lower accounting quality are more likely to use discretionary bonuses to compensate CEOs.

5.6 Additional analysis

Board directors might subjectively evaluate the compliance of CEO actions with a firm's long-term strategy and use discretionary bonuses to compensate CEOs for actions that increase a firm's long-term growth. In additional analysis, we separate data into firms with high growth potential and low growth potential based on firms' market-to-book ratio, which is often used as an indicator of growth potential (Brief & Lawson, 1992; Penman, 1996). The results in Table 11 are consistent for both firms with high growth potential and firms with low growth potential: accounting quality is negatively related to CEO discretionary bonuses.

In the following robustness test, we show that the negative relationship between accounting quality and discretionary bonuses is not explained by firm or industry volatility, despite prior evidence linking volatility to greater subjectivity in CEO pay. Because explicit contracts cannot account for unforeseeable factors, high performance volatility introduces noise into objective measures and raises executives' risk of missing performance targets. Discretionary bonuses can mitigate this risk (Gibbs *et al*., 2004). Consistent with this, Höppe and Moers (2011) show that subjectivity in CEO pay is positively associated with uncontrollable factors and industry volatility measured by the volatility of a firm's stock return and the volatility of industry return on assets.

The following analysis demonstrates that the documented negative relationship between accounting quality and discretionary bonuses is not driven by volatility or uncontrollable factors. In Table 12, we divide the sample into high-volatility and low-volatility subsamples based on the median volatility level, as well as into high-accounting-quality and low-accounting-quality subsamples based on the median accounting quality level [10]. Panel A shows that 51% of high-volatility firms have low accounting quality, compared to 49% of low-volatility firms.

The regressions in Panel B reveal that boards in both high- and low-volatility firms rely on discretionary bonuses to alleviate agency conflicts exacerbated by low accounting quality. Panel C shows that the difference in the coefficient on *Accounting Quality* between high-volatility and low-volatility firms is statistically insignificant.

Taken together, these results suggest that accounting quality captures a distinct concept from uncontrollable risks such as firm- or industry-level volatility. Importantly, there is a fundamental difference between low accounting quality and high performance volatility in their implications for CEO bonuses: high volatility increases CEOs' risk of missing objective performance targets and receiving formula-based bonuses, whereas low accounting quality provides CEOs with opportunities to manipulate accounting information, potentially reducing their risk of missing performance targets and thereby increasing their chances of earning formula-based bonuses.

Because boards might have determined at the beginning of the year what types of bonuses they will use to compensate CEOs, we use the next year's discretionary bonus as the dependent

Table 11. Partition data based on M/B ratio

	Discretionary Bonus			
	Low M/B ratio (1)	High M/B ratio (2)	Low M/B ratio (3)	High M/B ratio (4)
Intercept	−2.361***	−3.305***	−1.836***	−2.772***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Accounting Quality1$_{it}$	−0.207***	−0.336***		
	(0.003)	(<0.001)		
Accounting Quality2$_{it}$			−0.929***	−0.861***
			(0.001)	(0.003)
ROA Volatility$_{it}$	−2.519	−2.131	−2.533	−2.115
	(0.285)	(0.318)	(0.282)	(0.321)
Return Volatility$_{it}$	3.067***	3.428***	3.064***	3.590***
	(0.001)	(0.002)	(0.001)	(0.001)
CEO Tenure$_{it}$	0.034***	0.039***	0.034***	0.040***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
CEO Duality$_{it}$	−0.166*	−0.098	−0.172*	−0.094
	(0.061)	(0.276)	(0.052)	(0.293)
R&D to Sales$_{it}$	0.041	0.41	0.041	0.416
	(0.122)	(0.012)	(0.125)	(0.011)
B/M Ratio$_{it}$	0.049	0.823*	0.049	0.759*
	(0.198)	(0.054)	(0.200)	(0.075)
Loss$_{it}$	−0.308**	0.086	−0.313**	0.093
	(0.018)	(0.654)	(0.016)	(0.629)
Size$_{it}$	−0.092***	0.049	−0.096***	0.036
	(0.007)	(0.142)	(0.005)	(0.280)
Leverage$_{it}$	−0.509**	−0.616**	−0.54**	−0.661**
	(0.025)	(0.034)	(0.018)	(0.023)
Annual Return$_{it}$	0.269***	0.158**	0.273***	0.166**
	(0.001)	(0.019)	(0.001)	(0.015)
ROA$_{it}$	0.648	2.026***	0.628	2.090***
	(0.201)	(<0.001)	(0.216)	(<0.001)
Year indicators	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Number of observations	4,754	4,754	4,754	4,754
Pseudo R^2	0.093	0.079	0.094	0.077

Note(s): This table presents the logit regression results of the sample data partitioned into two subsamples depending on whether market to book ratio is above or below the sample median. Columns 1 and 3 present regression results of the observations with the market to book ratio below the sample median. Columns 2 and 4 present regression results of the observations with the market to book ratio above the sample median
In Columns 1 and 2, the independent variable *Accounting Quality1* is a composite measure, which is the average of standardized *Big4*, standardized *Earning Predict CF*, and the opposite of standardized *Abnormal Accruals*. In Columns 3 and 4, *Accounting Quality2* is also a composite measure, which is the average of the three ranks scaled by the number of observations: the rank in *Big4*, the rank in *Earning Predict CF*, and the rank in *Abnormal Accruals* (in decreasing order). All other variables are defined in Appendix. *, **, and *** indicate that the estimated coefficients are statistically significant at the 0.10, 0.05, and 0.01% level, respectively. *P*-values in brackets are from two-tailed *t*-tests

variable in a robust test. The untabulated results show that firms with low accounting quality are more likely to use direct supervision to address agency costs and more likely to compensate CEOs with discretionary bonuses. In an additional analysis, we examine the boards' use of direct supervision to address agency conflicts exacerbated by low accounting quality in firms with high and low corporate governance. Following Guest *et al.* (2022), corporate governance is measured by CEO/chair duality, board independence, busy board, CEO ownership, institutional ownership and entrenchment [11]. The results in Table 13 indicate that boards

Table 12. Partition data based on firm and industry volatility

Panel a percentage of low accounting quality observations

	Percentage of low accounting quality observations measured by *Accounting Quality1*	Percentage of low accounting quality observations measured by *Accounting Quality2*
High volatility firms	51%	51%
Low volatility firms	49%	49%

Panel B: Logit regression

	Discretionary Bonus			
	Low volatility (1)	High volatility (2)	Low volatility (3)	High volatility (4)
Intercept	−2.207***	−3.39***	−1.643***	−2.887***
	(<0.001)	(<0.001)	(0.003)	(<0.001)
Accounting Quality1$_{it}$	−0.283***	−0.257***		
	(0.001)	(<0.001)		
Accounting Quality2$_{it}$			−1.0763***	−0.785***
			(0.001)	(0.002)
ROA Volatility$_{it}$	2.704	−2.618	3.063	−2.583
	(0.684)	(0.166)	(0.645)	(0.171)
Return Volatility$_{it}$	3.330	3.150***	3.386	3.199***
	(0.267)	(<0.001)	(0.259)	(<0.001)
CEO Tenure$_{it}$	0.034***	0.040***	0.035***	0.040***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
CEO Duality$_{it}$	−0.247***	−0.083	−0.256***	−0.086
	(0.009)	(0.333)	(0.007)	(0.315)
R&D to Sales$_{it}$	−1.445	0.076**	−1.454	0.075**
	(0.119)	(0.015)	(0.115)	(0.018)
B/M Ratio$_{it}$	0.168*	0.051	0.167*	0.050
	(0.089)	(0.256)	(0.093)	(0.260)
Loss$_{it}$	−0.127	−0.228*	−0.12	−0.232*
	(0.524)	(0.067)	(0.546)	(0.063)
Size$_{it}$	−0.021	−0.019	−0.026	−0.031
	(0.574)	(0.532)	(0.489)	(0.317)
Leverage$_{it}$	−1.198***	−0.200	−1.224***	−0.228
	(<0.001)	(0.367)	(<0.001)	(0.306)
Annual Return$_{it}$	0.400***	0.123**	0.399***	0.129**
	(0.004)	(0.015)	(0.005)	(0.012)
ROA$_{it}$	1.596**	0.821**	1.632**	0.847**
	(0.043)	(0.036)	(0.039)	(0.031)
Year indicators	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Number of observations	4,755	4,755	4,755	4,755
Pseudo R^2	0.072	0.089	0.072	0.087

(*continued*)

Table 12. Continued

Panel C: The difference between coefficients of low and volatility sample	
The difference between coefficients on Accounting Quality 1	0.004
p-value	(0.777)
The difference between coefficients on Accounting Quality 2	−0.008
p-value	(0.884)

Note(s): Panel A presents the percentage of low accounting quality observations among high and low volatility firms. Low accounting quality is the accounting quality below the median level measured by *Accounting Quality1* and *Accounting Quality2*. High (low) volatility is the volatility above (below) the median level measured by the average of standardized *ROA Volatility* and standardized *Return Volatility*

Panel B presents the logit regression results of the sample data partitioned into two subsamples depending on whether volatility level is above or below the sample median. Columns 1 and 3 present regression results of the observations with the volatility level below the sample median. Columns 2 and 4 present regression results of the observations with the volatility level above the sample median. The volatility level is a composite measure, which is the average of standardized *ROA Volatility* and standardized *Return Volatility.* In Columns 1 and 2, the independent variable *Accounting Quality1* is a composite measure, which is the average of standardized *Big4*, standardized *Earning Predict CF,* and the opposite of standardized *Abnormal Accruals*. In Columns 3 and 4, *Accounting Quality2* is also a composite measure, which is the average of the three ranks scaled by the number of observations: the rank in *Big4*, the rank in *Earning Predict CF*, and the rank in *Abnormal Accruals* (in decreasing order)

In Panel C the difference and its significance between coefficients in two regressions of high and low volatility samples are measured by linear probability model. The *P*-values in the tests of the difference are from two-tailed Z-tests as per Clogg *et al.* (1995) and Paternoster *et al.* (1998). All other variables are defined in Appendix. *, **, and *** indicate that the estimated coefficients are statistically significant at the 0.10, 0.05, and 0.01% level, respectively. *P*-values in brackets are from two-tailed *t*-tests

tend to use direct supervision to address agency conflict exacerbated by low accounting quality in both strong and weak corporate governance firms.

6. Conclusions

Due to information asymmetry, CEOs might "shirk" or engage in actions that benefit themselves at the expense of shareholders. Low-quality accounting – which increases information asymmetry and decreases the reliability of accounting measures to evaluate CEO performance – exacerbate agency conflicts. In addition to monitoring through the use of accounting, monitoring through direct supervision can also reduce agency conflicts. Using Big Four auditors, abnormal accruals and earnings' ability to predict future cash flows as proxies for accounting quality, and a CEO's discretionary bonus as a proxy of a board's direct supervision, we find that boards tend to use direct supervision and subjective evaluation of CEO performance to alleviate agency conflicts that intensify with low accounting quality intensifies.

We obtain CEO compensation data from ExecuComp, which collects compensation data from S&P 1500 firms. Because S&P 1500 firms are relatively large companies, findings in this study might be limited to large firms. This study uses the actual discretionary bonus and formula bonus paid by a firm to examine the firm's decisions to choose a discretionary or a formula bonus to compensate a CEO. A firm's performance might affect whether a CEO receives a bonus. Thus, the data utilized here might be subject to selection bias. This research employs PSM to address the potential selection bias by matching observations in which CEOs are only granted discretionary bonuses with observations in which CEOs solely receive formula bonuses on firm characteristics and firm performance. In this study, we use the CEO discretionary bonus as a proxy for direct supervision. This measure has limitations and cannot be used for all direct supervision situations, e.g. financial restatements. A board might view financial restatements as significant mistakes when other signals of low accounting quality –

such as the use of non-Big Four auditors, a low relationship between current earnings and future cash flows, and large abnormal accruals – are not considered reflective of a CEO's mistakes. CEOs might face severe penalties for financial restatements (Lambert, 2001; Armstrong *et al.*, 2010; Desai, Hogan, & Wilkins, 2006) and hence not receive performance compensation such as discretionary bonuses. In this situation, the absence of bonus payments for CEO mistakes does not indicate that the board will not use direct supervision to alleviate agency conflicts.

Direct supervision of the CEO requires substantial director involvement, including visits to primary operations, research and development facilities and other key divisions, as well as meetings with executives, managers and the CEO, and reviews of informal reports and materials (Browning & Sparks, 2016; Rajan & Reichelstein, 2009; Stafford & Schindlinger, 2019; White, 2014). Certain firm environments or characteristics may facilitate such direct

Table 13. Partition data based on corporate governance

Panel A: Logit regression

	Discretionary Bonus			
	Low corporate Governance (1)	High corporate Governance (2)	Low corporate Governance (3)	High corporate Governance (4)
Intercept	−1.873**	−2.675***	−1.393*	−1.928**
	(0.010)	(<0.001)	(0.06)	(0.011)
Accounting Quality1$_{it}$	−0.283**	−0.423***		
	(0.015)	(<0.001)		
Accounting Quality2$_{it}$			−0.872**	−1.277***
			(0.036)	(0.002)
ROA Volatility$_{it}$	−3.107	2.375	−3.034	2.485
	(0.349)	(0.541)	(0.359)	(0.522)
Return Volatility$_{it}$	4.562**	−0.232	4.578**	−0.02
	(0.022)	(0.904)	(0.021)	(0.992)
CEO Tenure$_{it}$	0.049***	0.029***	0.050***	0.029***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
CEO Duality$_{it}$	−0.278**	−0.121	−0.285**	−0.105
	(0.035)	(0.370)	(0.031)	(0.437)
R&D to Sales$_{it}$	−1.488*	−0.143	−1.483*	−0.175
	(0.071)	(0.783)	(0.071)	(0.744)
B/M Ratio$_{it}$	−0.275*	0.320*	−0.273*	0.318*
	(0.080)	(0.084)	(0.085)	(0.086)
Loss$_{it}$	−0.133	−0.308	−0.137	−0.285
	(0.576)	(0.200)	(0.565)	(0.234)
Size$_{it}$	−0.059	−0.079	−0.065	−0.096*
	(0.241)	(0.161)	(0.199)	(0.088)
Leverage$_{it}$	−2.338***	−0.743*	−2.361***	−0.782*
	(<0.001)	(0.073)	(<0.001)	(0.059)
Annual Return$_{it}$	0.024	0.459***	0.028	0.473***
	(0.885)	(0.002)	(0.865)	(0.001)
ROA$_{it}$	0.406	2.105**	0.475	2.285**
	(0.676)	(0.019)	(0.625)	(0.011)
Year indicators	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Number of observations	2,587	2,587	2,587	2,587
Pseudo R^2	0.117	0.089	0.116	0.086

(*continued*)

Table 13. Continued

Panel B: The difference between coefficients of low and high corporate governance sample	
The difference between coefficients on Accounting Quality 1	0.019
p-value	(0.322)
The difference between coefficients on Accounting Quality 2	0.051
p-value	(0.473)

Note(s): This table presents the logit regression results of the sample data partitioned into two subsamples depending on whether a firm's corporate governance level is above or below the sample median. Columns 1 and 3 present regression results of the observations with the corporate governance level below the sample median. Columns 2 and 4 present regression results of the observations with the corporate governance level above the sample median. The corporate governance level is a composite of multiple measures, board independence, CEO ownership, institutional ownership, busy board, CEO chair duality, and Entrenchment, which are included in the research of Guest *et al.* (2022). The corporate governance level is measured by the average of standardized percentage of independent directors on a board, standardized CEO ownership percentage, standardized institutional ownership percentage, the opposite of standardized CEO chair duality, the opposite of standardized busy director percentage on a board, and the opposite of standardized entrenchment score
In Columns 1 and 2, the independent variable *Accounting Quality1* is a composite measure, which is the average of standardized *Big4*, standardized *Earning Predict CF*, and the opposite of standardized *Abnormal Accruals*. In Columns 3 and 4, *Accounting Quality2* is also a composite measure, which is the average of the three ranks scaled by the number of observations: the rank in *Big4*, the rank in *Earning Predict CF*, and the rank in *Abnormal Accruals* (in decreasing order)
The difference and its significance between coefficients in two regressions of high and low corporate governance samples are measured by linear probability model. The *P*-values in the tests of the difference are from two-tailed Z-tests as per Clogg *et al.* (1995) and Paternoster *et al.* (1998). All other variables are defined in Appendix. *, **, and *** indicate that the estimated coefficients are statistically significant at the 0.10, 0.05, and 0.01% level, respectively. *P*-values in brackets are from two-tailed *t*-tests

supervision. In this study, we employ firm fixed effects to control for firm characteristics that could influence both direct supervision and the use of discretionary bonuses in CEO compensation. Future research could investigate which specific firm characteristics enable boards to rely more heavily on direct observation.

The findings of this study have broader applicability to other contexts involving agency conflicts. For example, future work could examine how boards in firms with lower accounting quality use direct supervision to assess executive performance for promotion or dismissal decisions. Future research could also investigate the methods that firms utilize to alleviate information asymmetry and agency conflicts intensified by financial restatements, which is not examined in this study.

More intense direct supervision of firm performance might deter the management's opportunistic actions and improve accounting quality. However, such an impact will work against finding our documented results.

This paper contributes to agency theory by demonstrating that board' direct supervision plays an essential role in alleviating agency conflicts between CEOs and shareholders even in public firms. Regulators and boards can benefit from the findings of this study. Concerned with agency conflicts and accounting scandals, in recent years regulators have required increased board independence and outside shareholders' participation in monitoring activities such as "Say on Pay Vote". In practice, those requirements curtail boards' utilization of direct supervision to mitigate agency conflicts because independent directors and especially outside shareholders have limited access to CEOs and executives. To address the side effects of increased board independence and outside shareholders' participation in monitoring activities, regulations that encourage boards' direct supervision of CEOs and executives might be needed.

Notes

1. Viz., CEOs can manage earnings upward around stock sales and option exercises, manage earnings downward before option grants, and report cash flows from other sources – such as bank loans – as cash flows from operating activities (e.g. Healy & Wahlen, 1999; Dechow & Sloan, 1991; Cornett *et al.*, 2008; Beneish & Vargus, 2002; McAnally *et al.*, 2008; Smith, 2011).
2. In a sample of 317 firms that used objective performance measures to compensate their CEOs, Ittner, Larcker, and Rajan (1997) find that 312 firms employed financial measures, including 109 that utilized a combination of financial and nonfinancial measures.
3. Before the Tax Cuts and Jobs Act (TCJA) of 2017 became effective on January 1, 2018, CEO formula bonuses were tax-deductible. TCJA of 2017 significantly changed the tax deductibility of executive compensation, including formula bonuses. Some CEO 2017 compensation could be paid and taxed after 2017. Boards and compensation committees might have adjusted CEO 2017 compensation because of the tax law changes. Thus, observations in 2017 and later could be different from those prior to 2017. The global COVID pandemic might also have affected firms' payment of discretionary bonuses. Thus, the sample data used for this research do not include observations of CEO compensation for 2017 and subsequent years.
4. Cash compensation includes salary, discretionary bonuses, and formula-based bonuses.
5. Observations corresponding to a CEO's final year in office are excluded from the sample, alleviating concerns regarding confounding factors associated with CEO turnover or dismissal.
6. For robustness, we exclude the observations in which CEOs garner no bonuses or are granted both types of bonuses. The untabulated results are consistent with those of the regressions using the entire sample. Boards of firms with low accounting quality are more likely to use direct observation to mitigate agency conflicts and more likely to evaluate CEOs subjectively.
7. *Discretionary Bonus Weight* is computed with the amount of discretionary bonuses, which is determined by CEO performance level based on directors' subjective evaluation: how well the CEO's actions comply with the firm's strategy and increase firm value. Because *Discretionary Bonus Weight* is influenced by CEO performance level, it is a noisy measure of the board's choice of subjective evaluation and discretionary bonus. As a result, this study employs the indicator variable as the primary measure of discretionary bonus and use the continuous variable only as a robust test.
8. CEO contract arrangements are relatively persistent (Curtis *et al.*, 2021). A board is unlikely to make frequent changes in CEO compensation arrangement and the methods to evaluate CEO performance. Thus, a board might not change the CEO compensation arrangement immediately after an exogenous event. Consistent with previous research on discretionary bonuses, this study does not utilize an external shock analysis to rule out potential uncontrolled confounding factors. Instead, we use ITCV analysis the demonstrate it is unlikely that the relation between CEO discretionary bonus and low accounting quality is caused by missing variables.
9. After standardization, each variable has a mean of zero and a standard deviation of one.
10. The volatility level is a composite measure, which is the average of standardized *ROA Volatility* and standardized *Return Volatility*. The accounting quality level is measured by *Accounting Quality1* and *Accounting Quality2*.
11. Independent directors are essential for the effective functioning of the board and protecting shareholder interest to curtail the management's manipulative activities (Masulis & Zhang, 2019; Sun, 2023). Managers' equity ownership help align managers' interests with shareholders' interests (Fama & Jensen, 1983; Jensen & Meckling, 1976; Nyberg, Fulmer, Gerhart, & Carpenter, 2010). Institutional investors have the financial interest and independence to monitor firm management and policies, and curtain their self-serving behavior (Jensen, 1993; Shleifer & Vishny, 1997; Collins, Gong, & Li, 2009). CEOs who serve as board chairs have greater power over board members (Collins *et al.*, 2009). Busy directors spend insufficient time for the discharge of their responsibilities (Lipton & Lorsch, 1992; Ferris, Jagannathan, & Pritchard, 2003). Entrenchment Score (E-Index) developed by Bebchuk, Cohen, and a Ferrell (2009), is often used as a measure of CEO entrenchment and CEO power in prior literature (Kang & Kroll, 2014). The corporate governance level is a composite measure, which is the average of standardized percentage of independent directors on a board,

standardized CEO ownership percentage, and standardized institutional ownership percentage, the opposite of standardized CEO chair duality, the opposite of standardized busy director percentage on a board, and the opposite of standardized entrenchment score.

Supplementary material

The supplementary material for this article can be found online

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