# Implications of economic shocks for CEO performance evaluation[*,†]

Claudine Mangen[‡]

March 31, 2016

**Abstract**

I study the implications of economic shocks for objective and subjective CEO performance evaluation. A shock perturbs pay-setting parties' information about the firm and the CEO. I argue that pay-setting parties then lack information they need for evaluating the CEO objectively, and de-emphasize objective CEO performance evaluation in favour of subjective CEO performance evaluation; over time, pay-setting parties become better informed about the firm as well as the CEO, and increasingly use again objective CEO performance evaluation. My evidence, which uses data on objective and subjective CEO performance evaluation in U.S. executive pay between 1992 and 2013, is consistent with my argument.

**Keywords**: executive pay, economic shocks, learning, CEO performance evaluation

**JEL codes**: J33, G34, M12, M41, M52

[*]Accepted by Laurence van Lent. Date of first submission: August 30, 2013. Date of final acceptance: March 14, 2016. This study has benefitted from suggestions of Ana Albuquerque, James Brickley, John Core, Liz Demers, Ron Jones, Andrew Leone, David Maber, Luis Marques, Artem Prokhorov, Shailendra Pandit, Zvi Singer, Randall Stone, Alessia Testa, Laurence van Lent, Joanna Wu, Jerry Zimmerman, and an anonymous reviewer, as well as seminar participants at the Instituto di Empresa in Madrid, the University of Rochester, and the meetings of the American Accounting Association, the Canadian Academic Accounting Association and the European Accounting Association. This work was supported by the RBC Professorship in Responsible Organizations; Social Sciences and Humanities Research Council Canada under Grant S01203; the Concordia University Research Fund under Grant V00473; and the Luxembourgian Scientific and Applied Research Scholarship Fund under Grant BFR02/033. This paper is based on my Ph.D. dissertation at the University of Rochester. All errors are my own.

[†]Additional materials are available in an Online Supplement at the journal's Taylor and Francis website.

[‡]John Molson School of Business, Concordia University, Montréal, Canada. Telephone: +1 514 848 2424, extension 2747. Fax: +1 514 848 4518. Email address: claudine.mangen@concordia.ca

# 1 Introduction

Recent history has witnessed a series of economic shocks, including the 1999–2001 burst of the internet bubble and the 2007–2009 subprime mortgage crisis.[1] I study how shocks shape objective and subjective CEO performance evaluation. I explore objective CEO performance evaluation using the sensitivity of CEO cash pay to earnings. Shocks can affect this sensitivity through three channels. First, shocks can shift a firm's investment opportunities, which shape the sensitivity of CEO cash pay to earnings (Smith & Watts, 1992). Second, shocks can represent factors outside of a CEO's control and, as such, have implications for the pay–performance sensitivity (Albuquerque, 2009; Bertrand & Mullainathan, 2001).

My interest lies in a third, unexplored channel: shocks can disturb pay-setting parties' information about earnings, specifically their information about how earnings are determined by CEO ability and factors outside of CEO control (henceforth: noise). Pay-setting parties set the sensitivity of CEO cash pay to earnings in light of their information about these two parameters; however, their information is perturbed when a shock occurs, and pay-setting parties need to estimate post-shock CEO ability and post-shock noise. This estimation process gives rise to estimation risk; that is, the estimated values of post-shock CEO ability and noise have higher variability than their full information counterparts. To mitigate the impact of estimation risk on a risk-averse CEO, pay-setting parties lower the sensitivity of CEO cash pay to earnings after a shock. Over time, pay-setting parties learn about post-shock CEO ability and noise, and estimate these more precisely. Estimation risk declines, and the sensitivity of CEO cash pay to earnings can be raised. My first hypothesis predicts that the sensitivity of CEO cash pay to earnings increases as time passes after a shock occurs.

To identify shocks, I rely on extreme market-adjusted stock returns: a firm experiences a shock when its annual market-adjusted return belongs to the decile of the most positive or to the decile of the most negative market-adjusted returns across all sample observations. Of

[1] I follow Mitchell and Mulherin (1996) and define shocks as unexpected structural modifications in a firm's economic environment.

my sample of 2,737 U.S. firms, 1,948 (71.2%) experienced at least one shock between 1950 and 2012. Using executive pay data from EXECUCOMP between 1992 and 2013, I find a significantly positive association between the sensitivity of CEO cash pay to a firm's post-shock earnings, and the number of years gone by since the firm experienced its last shock. Immediately after a shock, the sensitivity of CEO cash pay to earnings is such that a 10% increase in earnings results in a 3.4% raise in CEO cash pay. As the number of years since the shock rises to its median (i.e., 5), the sensitivity of CEO cash pay to earnings increases by about 20%: the pay–performance sensitivity is such that a 10% increase in earnings leads to a 4.0% raise in CEO cash pay.

I consider alternative explanations for my findings. After a shock, firms may change their pay–performance sensitivity because the shock modifies their investment opportunity set or because the shock represents noise. To address this concern, I control for a firm's growth options and noise (Lambert & Larcker, 1987; Smith & Watts, 1992) as well as for earnings persistence and CEO tenure (Baber, Kang, & Kumar, 1998; Sloan, 1993). Next, my analysis assumes that shocks are exogenous. It is possible, however, that firms experiencing fewer shocks have distinct investment, financing, and governance policies that set them apart from firms experiencing more shocks; these distinct policies may account not only for the shocks but also for the post-shock pay–performance sensitivity. I address this possibility in two ways. First, I explore exogenous shocks, which I proxy for by using U.S. macro-economic shocks (i.e., recessions and expansions) between 1990 and 2009. My results show that firms increase the sensitivity of CEO cash pay to earnings as time passes since a macro-economic shock occurred. Second, I control for a firm's resilience to shocks. Firms may build up resilience to shocks because of their investment, financing, and governance policies. I measure resilience using the slope coefficient from a regression of a firm's earnings on its market-adjusted returns. My findings remain unchanged; they also show that resilience is positively associated with the sensitivity of CEO cash pay to earnings.

The reduced post-shock association between CEO cash pay and earnings raises the question of how firms set CEO cash pay right after a shock. The literature indicates that CEO cash pay is often determined subjectively (Bushman & Indjejikian, 1993; Moers, 2002). Pay-setting parties rely on subjective CEO performance evaluation when objective performance measures such as earnings are problematic (Baker, Gibbons, & Murphy, 1994; Bushman, Indjejikian, & Smith, 1996; Gibbs, Merchant, Van der Stede, & Vargus, 2004). After a shock, earnings are problematic for setting pay since pay-setting parties lack information about post-shock earnings. The pay-setting process can be improved when pay-setting parties wait until year-end to set CEO cash pay subjectively ex post. Doing so provides them with additional time to gather information about the post-shock environment. I predict that firms draw more intensively on subjective performance evaluation right after a shock. To test this hypothesis, I hand-collect data on subjective performance evaluation from corporate proxy filings for a subsample of 353 firms.

Univariate tests show that, right after a shock, firms rely to a larger extent on subjective performance evaluation. In particular, the number of firms that use subjective performance evaluation increases by 5.5% after a shock. Also, firms use a larger number of performance measures in their subjective performance evaluation. Firms rely, on average, on 2.16 subjective performance measures after a shock, compared to 1.85 in the shock year. My univariate results are significant after comparison with control firms that do not experience shocks and that are matched to shock firms by size and industry. Because my matching procedure may fail to successfully account for variables shown by the literature to determine subjective performance evaluation (i.e., growth options, risk, size, losses, and CEO tenure), I use a multivariate approach to control for these variables (Bushman et al., 1996; Gibbs et al., 2004; Indjejikian & Nanda, 2002; Raith, 2008; Rajan & Reichelstein, 2009); my univariate results hold. This evidence suggests that, right after a shock, firms increasingly rely on subjective performance evaluation for setting CEO cash pay.

Overall, my study broadens our understanding of how economic shocks shape CEO performance evaluation. I highlight that shocks can perturb the information that pay-setting parties need for evaluating the CEO. My results suggest that right after a shock, when pay-setting parties have little information about the post-shock environment, firms rely less on objective CEO performance evaluation, as indicated by a weaker post-shock pay–performance sensitivity, and instead use subjective CEO performance evaluation to a larger extent. In other words, firms substitute objective CEO performance evaluation with subjective CEO performance evaluation. As time passes after a shock and pay-setting parties accumulate information about the post-shock environment, firms increasingly rely again on objective CEO performance evaluation. While the literature on CEO performance evaluation is rich and has provided us with many useful insights (Devers, Cannella, Reilly, & Yoder, 2007; Faulkender, Kadyrzhanova, Prabhala, & Senbet, 2010), it has not explored the role of shocks in disturbing the information that pay-setting parties require. My study steps into this void by analyzing the implications of this disturbance for CEO performance evaluation. This analysis is instructive as it shows that CEO performance evaluation is not static in an environment characterized by shocks, but shifts between subjective and objective CEO performance evaluation with the time that passes since a shock occurred.

My study also contributes to our understanding of subjective CEO performance evaluation, by focusing on the specific context of shocks. This context is informative, as it is characterized by heightened uncertainty. Researchers have theorized that subjective performance evaluation is beneficial in situations of increased uncertainty (Baker et al., 1994; Bushman et al., 1996; Gibbs et al., 2004). Yet, no study has provided empirical support for this prediction. My study is the first to document that subjective CEO performance evaluation is associated with uncertainty, and used more intensely right after shocks when uncertainty is higher. This result suggests that in an environment characterized by heightened uncertainty, firms substitute objective CEO performance evaluation with subjective CEO performance evaluation. This evidence speaks to the question, raised by Van der Stede (2011), of whether firms are

'more prone to use subjectivity to correct for uncontrollable factors due to volatile business conditions' (p. 616). My study answers affirmatively.

The rest of this study is organized as follows. Section 2 develops testable predictions of how shocks affect earnings-based CEO cash pay. Section 3 details the sample selection and describes shocks. Section 4 outlines the empirical analysis, discusses the results regarding the sensitivity of CEO cash pay to earnings, and provides further tests. Section 5 discusses the evidence regarding subjective performance evaluation. Section 6 concludes.

# 2 Hypothesis Development

To characterize CEO cash pay in the presence of shocks, I use the standard principal–agent framework (Milgrom & Roberts, 1992). CEO cash pay $W$ depends on earnings $y$: $W = \alpha + \beta y$, where $\alpha$ is salary and $\beta$ the sensitivity of CEO cash pay to earnings $y$ (the focus of my analysis). I draw on Gibbons and Murphy (1992) to conceptualize earnings as a function of three parameters: $y = e + a + \eta$, where $e$ is CEO effort; $a$ is CEO ability; and $\eta$ is noise (e.g., a rival's output decisions), which is normally distributed with a mean $\theta$ and a variance $\sigma^2$. What differentiates the three parameters $e$, $a$, and $\eta$ is the information that pay-setting parties (i.e., the compensation committee and the CEO) have about each one of them.

Pay-setting parties know CEO effort $e$. This knowledge arises from the way CEO cash pay is determined: the compensation committee selects CEO effort so as to maximize the firm's profits, and sets the sensitivity $\beta$ of CEO cash pay to earnings to ensure that the CEO has no incentives other than to choose this effort. Although the compensation committee knows CEO effort, it can never verify this knowledge, since CEO effort is not observable (Lambert, 2001).

In contrast, pay-setting parties do not know CEO ability $a$ and noise $\eta$. This depiction deviates from the literature, which generally assumes that pay-setting parties know $a$ and

$\eta$. The latter assumption is justified when the firm's environment is stable and when pay-setting parties' information about CEO ability or noise is not disturbed. Shocks, however, perturb this information. Consider a negative shock, such as a new rival that enters the firm's product market. Pay-setting parties do not know how able the CEO will be in coping with harsher competition, nor how important noise (e.g., the rival's output decisions) will be in shaping the firm's post-shock earnings. Now take a positive shock, such as an increase in product market demand. Again, pay-setting parties do not know the CEO's ability in dealing with the heightened demand, nor do they know the importance of noise (e.g., rivals' responses to the increased demand) in the firm's post-shock earnings.

Pay-setting parties' lack of information about post-shock CEO ability and noise is salient as it has repercussions for CEO cash pay. After the shock, pay-setting parties need to estimate CEO ability and noise, since both parameters are required for setting the optimal sensitivity of CEO cash pay to earnings. The estimation process gives rise to estimation risk: estimated post-shock CEO ability and noise have higher variability than their full information counterparts. This added variability reflects pay-setting parties' uncertainty about the post-shock true values of CEO ability and noise.

Since a risk-averse CEO dislikes such variability, pay-setting parties reduce the sensitivity of CEO cash pay to earnings after the shock, when estimation risk is highest. Over time, as they gather information and learn about post-shock CEO ability and noise, they can more precisely estimate these two parameters. Estimation risk declines and the optimal sensitivity of CEO cash pay to earnings can be increased; that is, the sensitivity of CEO cash pay to earnings is negatively associated with estimation risk. This negative association is formally derived in Gibbons and Murphy (1992) for estimation risk that results from uncertainty about CEO ability; the Online Supplement provides the proof for estimation risk that ensues from uncertainty about noise. Empirically, I measure estimation risk as the time gone by since a shock occurred: estimation risk is lower when more years have elapsed

since the shock. My first testable prediction is as follows.

*Hypothesis 1. Ceteris paribus, the sensitivity of CEO cash pay to earnings rises with the number of years since the last shock occurred.*

The above discussion presumes that CEO cash pay is set ex ante for the year ahead. The compensation committee often adjusts CEO cash pay ex post, and uses subjective performance evaluation to appraise the CEO based on realized non-financial and financial performance (Bushman et al., 1996; Gibbs et al., 2004; Ittner, Larcker, & Meyer, 2003; Moers, 2002). The compensation committee is likely to use subjective performance evaluation more intensely right after a shock, because it lacks information about post-shock CEO ability and noise. Relying on subjective performance evaluation provides it with time to gather additional information, as it can wait until the year is over to subjectively adjust CEO cash pay based on information obtained during the year.

Such a use of subjective performance evaluation is consistent with research showing that subjective performance evaluation can mitigate problems with objective performance measures (Baker et al., 1994). Research has found that subjective performance evaluation is used more intensely when objective performance measures fail to capture all aspects of CEO effort (Gibbs et al., 2004). Also, scholars have predicted that firms use subjective performance evaluation more intensely when uncertainty is higher. Yet empirical research to date has failed to support this prediction. Gibbs et al. (2004) and Bushman et al. (1996) empirically examine the association between risk in performance measures and subjective performance evaluation, but do not find evidence of an association.

While subjective performance evaluation may be attractive after a shock, it is costly. The compensation committee may bias its performance evaluation or compress its ratings; the CEO can engage in influence activities (Gibbs et al., 2004; Moers, 2002; Prendergast & Topel, 1993). Ultimately, it is an empirical question whether the benefits from using subjective performance evaluation after a shock offset any associated costs. If so, I expect

that firms use subjective performance evaluation more intensely. My second hypothesis follows.

*Hypothesis 2. Ceteris paribus, firms that experience a shock use subjective performance evaluation more intensely for setting CEO cash pay in the subsequent year.*

# 3 Sample and Shocks

Sample selection is detailed in Table 1. CEO compensation data are from EXECUCOMP, accounting data from COMPUSTAT, and stock price data from CRSP. Instances where the CEO is in office for less than a fiscal year and where the CEO serves at more than one firm are excluded. Observations without earnings data from COMPUSTAT or return data from CRSP, as well as observations with fiscal year end changes, are discarded. The final sample has 2,737 firms (25,383 firm-years) between 1992 and 2013.

–INSERT TABLE 1 HERE–

A firm-specific shock occurs when a firm's annual market-adjusted return belongs to the decile of the most positive market-adjusted returns or the decile of the most negative market-adjusted returns, across all years between 1950 and 2012, for all sample firms.[2] Table 2 shows the number, and percentage, of sample firms that experience no or at least one firm-specific shock since 1950. Of the 2,737 sample firms, 789 (28.8%) do not experience a shock, while 1,948 (71.2%) experience at least one shock. 587 firms (21.5%) have exactly one shock, 431 (15.8%) two shocks, 301 (11.0%) three shocks, 250 (9.1%) four shocks, 137 (5.0%) five shocks, and 242 (8.8%) more than five shocks. The maximum number of shocks per firm is 14, experienced by two firms.

[2]I choose 1950 as the starting year to ensure that I correctly count the number of years since the last shock occurred for firms that experience a shock before the sample period starts in 1992. I choose 2012 as the ending year because the test of Hypothesis 1 involves counting the number of years since a shock occurred; in the last year of my sample, 2013, I then have at least one observation for firms that experience a shock in 2012.

–INSERT TABLE 2 HERE–

I capture the time elapsed since the last shock using the variable $Number_{i,t}^{FS}$, which counts the number of years, for each firm $i$, since the last firm-specific shock, up until and including year $t$. Table 3 shows that the average [median] number of years since the last shock is 7.55 [5].

–INSERT TABLE 3 HERE–

# 4 Tests of Hypothesis 1

## 4.1 Regression Model

I use the following regression model to test Hypothesis 1.

$$\begin{aligned} CEOCashPay_{i,t} &= \beta Earnings_{i,t} + \boldsymbol{\gamma} Earnings_{i,t} Number_{i,t}^{FS} \\ &\quad + \delta Number_{i,t}^{FS} + \Lambda Earnings_{i,t} Controls + \Theta K + \varepsilon_{i,t}, \end{aligned} \tag{1}$$

where $CEOCashPay_{i,t}$ is the natural logarithm of cash pay (i.e., salary and bonus) the CEO of firm $i$ earns in fiscal year $t$. The natural logarithm controls for skewness in pay data. Table 3 shows that average CEO cash pay (bonus pay) is $\$837,028$ ($\$359,625$). $Earnings_{i,t}$ is income before extraordinary items and discontinued operations, scaled by prior-year total assets. Average (median) earnings are 4.4% (5.2%). All variables are detailed in Appendix B. Hypothesis 1 predicts that the sensitivity of CEO cash pay to earnings increases with the number of years since the last shock, implying that the coefficient $\gamma$ is positive.

I make no prediction for the coefficient $\delta$, which captures the association between CEO cash pay and $Number_{i,t}^{FS}$. As more years elapse after a shock and the pay–performance sensitivity increases, expected CEO incentive pay is higher; for a given reservation wage, the CEO requires lower salary. Moreover, $Number_{i,t}^{FS}$ affects CEO cash pay via the CEO's

risk premium, in two opposing ways. First, a higher $Number_{i,t}^{FS}$ reflects lower estimation risk, which decreases the CEO's risk premium, and salary falls. Second, the sensitivity of CEO cash pay to earnings rises with $Number_{i,t}^{FS}$, which increases the CEO's risk premium, and salary rises. The overall impact of $Number_{i,t}^{FS}$ on salary and CEO cash pay depends on which one of the latter three effects dominates.

The matrix *Controls* includes variables that have been shown in the literature to be associated with the sensitivity of CEO cash pay to earnings: CEO tenure, the book-to-market ratio, risk from earnings noise, and earnings persistence (Baber et al., 1998; Gibbons & Murphy, 1992; Lambert & Larcker, 1987; Smith & Watts, 1992). Untabulated results show that $Number_{i,t}^{FS}$ is significantly negatively correlated with the book-to-market ratio, and significantly positively correlated with CEO tenure, risk from earnings noise, and earnings persistence.

The coefficient $\beta$ captures the pay–performance sensitivity to earnings when $Number_{i,t}^{FS}$ and the variables in *Controls* are not included in regression (1), or when they do not affect the association between CEO cash pay and earnings. In this case, $\beta$ is expected to be positive. However, research suggests that the variables in *Controls* influence the association between CEO cash pay and earnings. To then interpret this association, the coefficient $\beta$ needs to be considered in conjunction with the coefficients in $\Lambda$. Furthermore, if $Number_{i,t}^{FS}$ affects, as hypothesized, the association between CEO cash pay and earnings, the coefficient $\gamma$ has to be taken into account as well.

Control variables for the level of CEO cash pay are in $K$. CEO cash pay is associated with firm characteristics (i.e, size, growth options, firm risk, stock returns) and CEO characteristics (i.e., CEO tenure, the presence of a CEO-chairman, the presence of an interlocked CEO) (Aggarwal & Samwick, 1999; Core, Holthausen, & Larcker, 1999; Deckop, 1988; Murphy, 1999, 2000; Smith & Watts, 1992). Regression (1) includes CEO and year fixed effects to control for unobservable factors that vary across CEOs and time, and influence CEO

pay (e.g., education, training, and responsibilities of the CEO). Regression (1) is estimated in the pooled cross-section via OLS, with standard errors clustered by firm and robust to heteroscedasticity.

## 4.2 Results

The results from estimating regression (1) are displayed in Table 4. They support Hypothesis 1: the sensitivity of CEO cash pay to earnings rises with the number of years since the last shock. In column (3), the coefficient on earnings interacted with $Number_{i,t}^{FS}$ is significantly positive at 0.016 ($t$-statistic: 2.30).[3] Economically, the sensitivity of CEO cash pay to earnings rises by about 20% when the number of years since the last shock increases from 1 to its median of 5.[4]

–INSERT TABLE 4 HERE–

Column (3) controls for other determinants of the pay–performance sensitivity to earnings. Comparing column (3) to column (1) reveals that including these determinants does not substantially alter how $Number_{i,t}^{FS}$ is associated with the pay–performance sensitivity. I find that, consistent with prior research, these determinants shape the sensitivity of CEO cash pay to earnings, which is higher when a firm has more growth options, less risk from earnings noise, and more persistent earnings. CEO tenure fails to be consistently associated with the pay–performance sensitivity.

[3]The analysis includes only observations from sample firms that experience at least one shock between 1950 and 2012. Also, it excludes 247 observations whose studentized residuals have an absolute value larger than 2. Such observations are problematic since they do not conform to the estimated model (Greene, 2012).

[4]Right after a firm-specific shock (i.e., $Number_{i,t}^{FS} = 1$), the pay–performance sensitivity to earnings is $0.332 \cong 0.132 + 0.016 \times 1 + 0.184$, where 0.184 is the sum of the coefficients on $Earnings_{i,t}$ interacted with controls: $0.184 \cong (0.106)(1.84) + (-0.171)(0.75) + (-0.415)(0.51) + (0.279)(0.71)$, where 1.84, 0.75, 0.51, 0.71 are the average values for $CEOTenure_{i,t}$, $BooktoMarket_{i,t-1}$, $Risk_{i,t-1}$ and $Persistence_i$. This implies that a 10% point increase in earnings yields a $3.37\% = exp[0.332 \times 0.1] - 1$ rise in CEO cash pay, or $\$28,221$, when applied to average CEO cash pay of $\$837,028$. When the number of years since the last firm-specific shock rises to the median (i.e., $Number_{i,t}^{FS} = 5$), the pay–performance sensitivity to earnings is $0.396 \cong 0.132 + 0.016 \times 5 + 0.184$. This implies that a 10% point rise in earnings gives a $4.04\% = exp[0.396 \times 0.1] - 1$ increase in CEO cash pay, or $\$33,776$. The sensitivity of CEO cash pay to earnings thus increases by $19.9\% = \frac{4.04\% - 3.37\%}{3.37\%}$ as the number of years since the firm-specific shock rises from 1 to the median.

Finally, column (3) shows that the coefficient on $Number_{i,t}^{FS}$ is negative at $-0.003$ ($t$-statistic: $-2.25$), which suggests that CEOs require less cash pay as shocks recede into the past.

## 4.3 Further Tests

Underlying my analysis is the assumption that shocks are exogenous. This assumption is violated when shocks are influenced by a firm's investment, financing, and governance policies. I address this concern in two ways, as discussed below.

### 4.3.1 Macro-Economic Shocks

The assumption of exogeneity likely holds for macro-economic shocks. I identify such shocks using the latest business cycle data from the National Bureau of Economic Research (NBER), which defines, in the vicinity of my sample period, three recession periods (i.e., July 1990 through March 1991, March 2001 through November 2001, and December 2007 through June 2009) and three expansion periods (i.e., March 1991 through March 2001, November 2001 through December 2007, and from June 2009 onwards). I define the first year in each recession and expansion period as the year of the macro-economic shock. For the three recession periods, the years of macro-economic shocks are 1990, 2001, and 2007; for the three expansion periods, the years of macro-economic shocks are 1991, 2001, and 2009.

I define the variable $Number_{i,t}^{MACRO}$ as the number of years since the last macro-economic shock occurred, up until and including year $t$, starting in 1990 (i.e., the year of the first macro-economic shock in the vicinity of the sample period). As shown in Table 3, the average [median] number of years since the last macro-economic shock is 3.15 [3]. The results for testing Hypothesis 1 for macro-economic shocks, in column (1) of Table 5, show that the sensitivity of CEO cash pay to earnings rises with the number of years since the last macro-

economic shock, consistent with the evidence for firm-specific shocks.[5] The coefficient on earnings interacted with $Number_{i,t}^{MACRO}$ is significantly positive at 0.052 ($t$-statistic: 5.58). Economically, the sensitivity of CEO cash pay to earnings increases by 33% as the number of years since the last macro-economic shock rises from 1 to the median of 3.[6] This evidence is consistent with the findings from firm-specific shocks, which mitigates the concern that the latter results may obtain because of the potentially endogenous nature of firm-specific shocks.

–INSERT TABLE 5 HERE–

### 4.3.2 Resilience to Shocks

Firms with different investment, financing, and governance policies may have developed a distinct resilience to shocks. I address this possibility by constructing two empirical measures of resilience, one that captures resilience to firm-specific shocks and a second one that proxies for resilience to macro-economic shocks. To measure resilience to firm-specific shocks, I estimate, for each firm-year, a regression of earnings (the main performance measure) on market-adjusted returns (the basis for the measure of firm-specific shocks) during the 5 years preceding the sample year. I obtain the slope coefficient on market-adjusted returns, take its absolute value, and multiply it by $-1$. I call the resulting variable $Resilience_{i,t-1}^{FS}$: larger values of $Resilience_{i,t-1}^{FS}$ indicate that earnings are less associated with market-adjusted returns, and proxy for firm-years more resilient to shocks. To measure macro-economic shocks, I use a similar methodology. I estimate, for each firm-year, a regression of earnings on

[5] I exclude 386 observations whose studentized residuals have an absolute value larger than 2. See footnote 3.

[6] Right after a macro-economic shock (i.e., $Number_{i,t}^{MACRO} = 1$), the pay–performance sensitivity to earnings is $0.321 \cong 0.181 + 0.052 \times 1 + 0.088$, where 0.088 is the sum of the undisplayed coefficients on $Earnings_{i,t}$ interacted with controls. This implies that a 10% point increase in earnings yields a $3.26\% = exp[0.321 \times 0.1] - 1$ rise in CEO cash pay, or $\$27,282$, when applied to average CEO cash pay of $\$837,028$. When the number of years since the last macro-economic shock rises to the median (i.e., $Number_{i,t}^{MACRO} = 3$), the pay–performance sensitivity to earnings is $0.425 \cong 0.181 + 0.054 \times 3 + 0.088$. This implies that a 10% point rise in earnings yields a $4.34\% = exp[0.425 \times 0.1] - 1$ increase in CEO cash pay, or $\$36,317$. The sensitivity of CEO cash pay to earnings thus increases by $33\% = \frac{4.34\% - 3.26\%}{3.26\%}$ as the number of years since the macro-economic shock rises from 1 to the median of 3.

market returns (from the equally weighted CRSP market index) during the 5 years preceding the sample year. I obtain the slope coefficient on market returns, take its absolute value, multiply it by $-1$, and call this variable $Resilience_{i,t-1}^{MACRO}$. I assume that equally weighted market returns correlate with macro-economic shocks reported by the NBER.

I add my firm-specific and macro-economic resilience measures, as determinants of the sensitivity of CEO cash pay to earnings, to the regressions for firm-specific and macro-economic shocks. Table 5 shows that my earlier findings hold, for both types of shocks: the sensitivity of CEO cash pay to earnings rises with the number of years since the last shock, as shown in column (2) for macro-economic shocks and in column (4) for firm-specific shocks. The coefficient on $Number_{i,t}^{MACRO}$ interacted with $Earnings_{i,t}$ is significantly positive, at 0.053 ($t$-statistic: 5.69); the coefficient yielded by $Number_{i,t}^{FS}$ interacted with $Earnings_{i,t}$ is significantly positive, at 0.019 ($t$-statistic: 2.56). Comparing columns (2) and (4) to columns (1) and (3), which do not include resilience, indicates that adding resilience as a determinant of the sensitivity of CEO cash pay to earnings does not substantially modify the results. Resilience itself matters for firm-specific but not for macro-economic shocks. The coefficient on $Resilience_{i,t-1}^{FS}$ interacted with earnings is significantly positive at 0.016 ($t$-statistic: 1.93), suggesting that firms more resilient to firm-specific shocks have a higher sensitivity of CEO cash pay to earnings. For macro-economic shocks, the coefficient on the interaction of $Resilience_{i,t-1}^{MACRO}$ and earnings is positive but not statistically significant.

### 4.3.3 Other Tests

I perform five additional sensitivity tests, which are discussed and tabulated in the Online Supplement. In these tests, I document that the sensitivity of CEO cash pay to earnings falls in the first year after a shock, and that my results hold for CEO bonus pay as well as for total CEO pay. I also find that the results are stronger for negative than for positive firm-specific shocks. Finally, I show that the evidence is not driven by changes in CEO risk tolerance after a shock.

# 5 Tests of Hypothesis 2

This section tests Hypothesis 2, which predicts that firms experiencing shocks use subjective performance evaluation more intensely for setting CEO cash pay in the subsequent year. Firms disclose information about subjective performance evaluation in their proxy statements. Since this information is not available in databases, it is retrieved directly from proxy statements. This process involves reading the section of the proxy statement that details how CEO cash pay is set. Due to the hand-collected nature of this data gathering process, I restrict the analysis of Hypothesis 2 to a subsample of the firms used for testing Hypothesis 1, as described next.

## 5.1 Subsample

My subsample comprises treatment and control firms. A treatment firm is a sample firm that experiences a shock in $t-1$ (i.e., its annual market-adjusted return belongs to the decile of the most positive market-adjusted returns or to the decile of the most negative market-adjusted returns, across all sample firm-years), has information on CEO cash pay available in its proxy statements, and can be matched to a control firm. A control firm is a sample firm that experiences no shock in $t-1$ (i.e., its annual market-adjusted return belongs to the decile of the least positive market-adjusted returns or to the decile of the least negative market-adjusted returns, across all sample firm-years), and has information on CEO cash pay available in its proxy statements. To choose the criteria that allow me to match treatment firms with control firms, I turn to studies on the determinants of subjective performance evaluation.

First, I match according to firm size (i.e., the $t-2$ market value of common equity). Firm size is associated with subjective performance evaluation (Bushman et al., 1996; Indjejikian & Nanda, 2002). Second, I match according to fiscal year and 2-digit SIC code to control for year and industry differences. The use of subjective performance evaluation varies

across industries, which differ in innovation, technology, product life/development cycles, and growth options (Bushman et al., 1996; Gibbs et al., 2004; Hayes & Schaefer, 2000; Makri, Lane, & Gomez-Mejia, 2006). My matching criteria rely on the assumption that subjective performance evaluation not related to shocks can be explained by firm size and industry. This assumption may be too ambitious, a concern I address in Section 5.4.

My subsample consists of 353 treatment and 353 control firms between 1993 and 2012. For each treatment and control firm, proxy statements are examined for information about subjective performance evaluation in $t-1$ (the year of the shock) and $t$.

## 5.2 Measuring Subjective Performance Evaluation

Firms can use subjectivity for setting CEO cash pay in three ways (Bushman et al., 1996; Gibbs et al., 2004; Ittner et al., 2003). First, they can exclusively rely on subjective judgement to determine CEO bonus. Second, they can ex post adjust financial and non-financial performance measures or ex post change the intensity with which they use them. Third, they can ex post adjust bonus awards based on performance measures other than those specified ex ante in the bonus contract.

Based on these criteria, I identify a firm as using subjective performance evaluation if it mentions 'subjective' and/or 'discretion' (or any variation thereof). I also consider individual performance measures to be subjective, following Bushman et al. (1996). Appendix A provides examples of subjective performance evaluation that involve discretion and individual performance measures. Finally, if a firm describes performance measures not explicitly specified ex ante in its proxy statement, those measures are considered to reflect subjectivity.

To measure the intensity with which firms use subjective performance evaluation, I use two criteria. First, firms mentioning subjective performance evaluation in their proxy statements are assumed to use subjective performance evaluation more intensely than firms not mentioning subjective performance evaluation. Second, firms that mention using a higher

number of performance measures for their subjective performance evaluation are considered to use subjective performance evaluation more intensely.

Hypothesis 2 implies that treatment firms increase their use of subjective performance evaluation from $t-1$ to $t$ significantly more than control firms. To test this hypothesis, I analyze univariate statistics regarding changes between $t-1$ and $t$ in subjective performance evaluation, before carrying out multivariate tests.

## 5.3 Univariate Analysis

I explore whether the use of subjective performance evaluation changes from $t-1$ to $t$, and whether the number of performance measures used subjectively changes as well.

Table 6 displays, in Panel A, the number and percentage of firms using subjective performance evaluation in $t-1$ (the year of the shock) and $t$. The majority of firms, be they treatment or control firms, use subjective performance evaluation in $t-1$. After a shock, subjective performance evaluation is used more intensely by treatment firms: 247 (70.0%) treatment firms utilize it in $t$, up from 234 (66.3%) in $t-1$, an increase of 5.6% ($= \frac{247-234}{234}$). In contrast, 211 (59.8%) control firms rely on subjective performance evaluation in $t$, down from 229 (64.9%) in $t-1$. Column (5) indicates that the difference in how intensely treatment and control firms use subjective performance evaluation is significant at the 1% level in $t$ ($\chi^2 = 8.06$), but not in $t-1$ ($\chi^2 = 0.16$). The evidence in Panel A suggests that firms are more likely to use subjective performance evaluation after a shock.

–INSERT TABLE 6 HERE–

Panel B of Table 6 shows the average number of performance measures that treatment and control firms use when evaluating their CEOs subjectively in $t-1$ and $t$. After a shock, firms increase the number of performance measures used for subjective performance evaluation. Treatment firms depend on 2.16 subjective performance measures in $t$, up from

1.85 in $t-1$. In contrast, controls use 1.52 subjective performance measures in $t$, down from 1.80 in $t-1$. The last row of column (3) reveals that treatment firms are significantly more likely than controls to significantly increase, between $t-1$ and $t$, the average number of performance measures used subjectively. The evidence in Panel B suggests that firms use a larger number of subjective performance measures after a shock.

The univariate analysis in Panels A and B of Table 6 controls for factors other than shocks that can shape subjective performance evaluation, by mobilizing a matched pair procedure that joins treatment to control firms based on firm size and industry. I explore the success of this matching procedure by comparing, across treatment and control firms, variables associated with subjective performance evaluation: growth options, risk, size, CEO tenure, and losses (Bushman et al., 1996; Gibbs et al., 2004; Hayes & Schaefer, 2000; Indjejikian & Nanda, 2002; Raith, 2008; Rajan & Reichelstein, 2009). Panel C of Table 6 displays, for treatment and control firms, the means of these variables in year $t$ after the shock. The evidence shows that treatment firms grow faster than controls, are riskier and smaller, and incur more losses. The differences between treatment and control firms are statistically significant for all variables except CEO tenure. This evidence suggests that the matching procedure does not successfully pair treatment firms with controls on all variables that have been shown in the literature to be associated with subjective performance evaluation. This raises the concern that the univariate results in Panels A and B are driven by the significant differences between treatment and control firms. To address this concern, I proceed to a multivariate analysis that accounts for the above variables.

## 5.4 Multivariate Analysis

My multivariate analysis explores a firm's increase, between $t-1$ and $t$, in the intensity with which it uses subjective performance evaluation, based on the following regression:

$$\begin{aligned} IncreaseSubjectivity_{i,t-1,t} &= \delta_0 + \delta_1 Treatment_i + \delta_2 BooktoMarket_{i,t} + \delta_3 Volatility_{i,t} \quad (2) \\ &\quad + \delta_4 Sales_{i,t} + \delta_5 Loss_{i,t} + \delta_6 CEOTenure_{i,t} + \varepsilon_{i,t,t-1}, \end{aligned}$$

where $IncreaseSubjectivity_{i,t-1,t}$ is either an indicator variable that equals 1 if a firm raises, between $t-1$ and $t$, the use of subjective performance evaluation, and 0 otherwise ($IncreaseSubjectivity_{i,t-1,t} = IncreaseUse_{i,t-1,t}$); or an indicator variable that equals 1 if a firm raises, between $t-1$ and $t$, the number of performance measures used subjectively, and 0 otherwise ($IncreaseSubjectivity_{i,t-1,t} = IncreaseNum_{i,t-1,t}$). A firm raises the use of subjective performance evaluation if it does not mention it in its proxy statement in $t-1$, but does mention it in its proxy statement in $t$. The variable $Treatment_i$ is an indicator variable that is 1 if a firm is a treatment firm, and 0 if it is a control. Regression (2) accounts for factors other than shocks that can shape subjective performance evaluation by including growth options, risk, size, the presence of losses, and CEO tenure. All variables are defined in Appendix B. If treatment firms increase, between $t-1$ and $t$, the intensity with which they use subjective performance evaluation to a larger extent than controls, the coefficient $\delta_1$ is significantly positive.

Equation (2) is estimated with a probit model; standard errors are robust and clustered by firm. Table 7 shows the results for the use of subjective performance evaluation (i.e., $Increase_{i,t-1,t} = IncreaseUse_{i,t-1,t}$). The evidence in column (3) indicates that treatment firms are more likely than controls to increase the use of subjective performance evaluation: the coefficient on $Treatment_i$ is significantly positive at 0.341 ($Z$-statistic: 2.04). This result is robust to controlling for other determinants of subjective performance evaluation, which do not have a sizable impact. In column (3), only growth options yield a significant coefficient at 0.426 ($Z$-statistic=1.72), suggesting that firms with fewer growth options are more likely

to boost subjective performance evaluation.

–INSERT TABLE 7 HERE–

Table 8 displays the findings for the number of performance measures used subjectively. Column (1) shows that treatment firms are more likely than control firms to increase the number of performance measures used subjectively. The coefficient on $Treatment_i$ is significantly positive at 0.460 ($Z$-statistic: 3.57). This result is driven by non-financial performance measures: column (2) shows that treatment firms are more likely than controls to increase the number of non-financial performance measures used subjectively, since the coefficient on $Treatment_i$ is significantly positive at 0.538 ($Z$-statistic: 3.61). Financial performance measures are also used more intensely by treatment than control firms, as shown in column (3). The only performance measures not differing between treatment and control firms are individual ones, in column (4). Of the determinants other than shocks, only growth options yield a positive coefficient, in columns (1) and (4).

–INSERT TABLE 8 HERE–

Collectively, the multivariate findings indicate that treatment firms are more likely than controls to increase the use of subjective performance evaluation between $t-1$ and $t$ and to draw on a higher number of performance measures for this performance evaluation. This result is robust to controlling for factors shown in the literature to shape subjective performance evaluation, thus confirming my univariate results.

# 6 Conclusion

This study examines the repercussions of economic shocks for objective and subjective CEO performance evaluation. I explore objective CEO performance evaluation using the sensitivity of CEO cash pay to earnings. I document that this sensitivity rises progressively

after a shock occurs. I interpret my result as suggesting that pay-setting parties learn over time about post-shock earnings. A shock perturbs the information that pay-setting parties have about the roles of CEO ability and noise in determining earnings. To set the sensitivity of CEO cash pay to earnings, they need these two parameters and therefore estimate them. The estimation process gives rise to estimation risk, that is, additional variation in estimated post-shock CEO ability and noise compared to their full-information counterparts. To mitigate the impact of estimation risk on a risk-averse CEO, pay-setting parties lower the sensitivity of CEO cash pay to earnings after a shock. As time passes and pay-setting parties learn about post-shock CEO ability and noise, they can estimate them more precisely, and raise the sensitivity of CEO cash pay to post-shock earnings. I control for determinants the literature shows are associated with the sensitivity of CEO cash pay to earnings (i.e., growth options, noise, CEO tenure, earnings persistence).

An alternative explanation for my results is that firms experiencing more shocks are different from firms experiencing fewer shocks, because of their investment, financing, and governance policies. I address this explanation in two ways. First, I explore exogenous shocks, which I measure using macro-economic shocks (i.e., expansions and recessions) from the NBER. I find that the sensitivity of CEO cash pay to earnings rises over time after a macro-economic shock occurs. Second, I develop a measure of how resilient firms are to shocks and include this measure in my analysis as a determinant of the sensitivity of CEO cash pay to earnings. My results hold.

My evidence suggests that firms rely less on objective CEO performance evaluation right after a shock than a few years later, when firms better understand the post-shock environment. This evidence raises the question of how firms set CEO cash pay right after a shock. I address this question by exploring subjective CEO performance evaluation. I document that firms increase the intensity with which they use subjective CEO performance evaluation immediately after a shock. This analysis is conducted using a subsample of firms for which information on subjective CEO performance evaluation is hand-collected from

proxy statements. Univariate results indicate not only that more firms use subjective CEO performance evaluation in the year after the shock, but also that they raise the number of performance measures they use subjectively. These results hold after comparison with control firms (matched by industry and size) that do not experience shocks. Because this match may not successfully account for all determinants of subjective CEO performance evaluation, I draw on multivariate tests that include these determinants. My results hold.

My study extends our understanding of how economic shocks shape CEO performance evaluation. It suggests that CEO performance evaluation is not static in an environment characterized by economic shocks. Instead, it fluctuates: firms rely less on objective CEO performance evaluation after a shock, when little is known about post-shock performance measures, only to progressively use it more intensely again as time passes since the shock occurred. Moreover, my findings imply that firms substitute objective with subjective CEO performance evaluation right after a shock.

# A Examples of Subjective CEO Performance Evaluation

This appendix provides two examples of subjective performance evaluation. The first example illustrates subjective performance evaluation that involves discretion of the compensation committee. The treatment firm Parametric Technology Corp. reports in its 2003 proxy statement that:

> 'The incentive plans for fiscal 2003 set forth two performance factors for each participating officer (including the Chief Executive Officer): revenue and operating margin. Target levels were established for each performance factor and a gross target bonus corresponding to each of the target levels was set. Because neither the revenue nor operating margin targets were met for fiscal 2003, funding for the incentive bonuses was at the Committee's discretion'. (Parametric Technology Corp, 2003)

The second example illustrates subjective performance evaluation based on individual performance measures. The treatment firm Royal Appliance writes in its 1994 proxy statement that 'The Committee based the 1994 compensation of Mr. Balch [its CEO] on the policies and procedures described above [in the section about the company's bonus plan]'. However, the company indicates that it also uses discretion: 'In addition, the Committee took into account its assessment of Mr. Balch's individual performance and his ability to expand and develop new markets and products'. (Royal Appliance MFG Co, 1994)

# B Variable Definitions

CEO compensation and return data are in 1992 constant U.S. dollars. Compensation data are from EXECUCOMP, accounting data from COMPUSTAT, and return data from CRSP.

- $BooktoMarket_{i,t-1}$: natural logarithm of book value in $t-1$ divided by the market value in $t-1$; the book value is total assets; the market value is the price per share at year end times the number of shares outstanding plus total assets minus common equity.
- $CEOCashPay_{i,t}$: natural logarithm of real CEO cash pay (in thousands of U.S. dollars) in $t$, which is salary (EXECUCOMP: SALARY) plus bonus pay (EXECUCOMP: BONUS).
- $CEOChair_{i,t}$: indicator variable that is 1 if the CEO chairs the board of directors in $t$, and 0 otherwise. The chair title is identified by searching the CEO title (EXECUCOMP: TITLEANN) for 'chmn' and 'chairman'.
- $CEOTenure_{i,t}$: natural logarithm of the number of years between the time the CEO of firm $i$ is appointed and the sample year $t$.
- $Controls$: control variables for the pay–performance sensitivity to earnings: $CEOTenure_{i,t}$, $BooktoMarket_{i,t-1}$, $Risk_{i,t-1}$ and $Persistence_i$.
- $Earnings_{i,t}$: income before extraordinary items and discontinued operations in $t$ scaled by total assets in $t-1$.
- $IncreaseSubjectivity_{i,t-1,t}$: either an indicator variable that is 1 if a firm increases, between $t-1$ and $t$, the use of subjective performance evaluation, and 0 otherwise ($IncreaseSubjectivity_{i,t-1,t} = IncreaseUse_{i,t-1,t}$); or an indicator variable that is 1 if a firm increases, between $t-1$ and $t$, the number of performance measures used subjectively, and 0 otherwise ($IncreaseSubjectivity_{i,t-1,t} = IncreaseNumber_{i,t-1,t}$).
- $InterlockedCEO_{i,t}$: indicator variable that is 1 if the CEO is interlocked in $t$, and 0 otherwise, as indicated by the variable INTRLOCK on EXECUCOMP. EXECUCOMP

defines CEOs as interlocked if they sit on their firm's compensation committee, or on the board of a company managed by an executive who sits on their firm's board.

- $K$: control variables for the level of CEO cash pay: $Sales_{i,t-1}$, $BooktoMarket_{i,t-1}$, $Volatility_{i,t-1}$, $r_{i,t} - r_{m,t}$, $CEOTenure_{i,t}$, $CEOChair_{i,t}$, and $InterlockedCEO_{i,t}$.

- $Loss_{i,t}$: indicator variable that is 1 if $Earnings_{i,t} < 0$, and 0 otherwise.

- $Number^{FS}_{i,t-1}$: the number of years since firm $i$ experienced the last firm-specific shock until (and including) $t$. A firm-specific shock occurs when its annual market-adjusted return belongs to the decline of the most positive market-adjusted returns or the decile of the most negative market-adjusted returns, across all sample firm-years.

- $Number^{MACRO}_{i,t}$: the number of years since firm $i$ experienced the last macro-economic shock until (and including) $t$. A macro-economic shock occurs in the first year of an expansion or a recession period, identified using data from the National Bureau of Economic Research (NBER). In the vicinity of the sample period (i.e., 1992–2013), the NBER defines three recession periods (i.e., July 1990 through March 1991, March 2001 through November 2001, and December 2007 through June 2009) and three expansion periods (i.e., March 1991 through March 2001, November 2001 through December 2007, June 2009 through date to be determined). For the three recession periods, the years of macro-economic shocks are 1990, 2001 and 2007; for the three expansion periods, the years of macro-economic shocks are 1991, 2001, and 2009.

- $Persistence_i$: earnings persistence, estimated between 1983 and 2013 for each firm $i$, from the following IMA(1,1) process (Baber et al., 1998): $A_t - A_{t-1} = UA_t - \Psi UA_{t-1}$, where $UA_{i,t}$ is the earnings innovation. $Persistence = 1 - \Psi$ captures the extent to which earnings innovations are permanent versus transitory. Table 4 shows that average (median) $Persistence$ is 0.71 (0.68); for comparison, the average (median) persistence in Baber et al. (1998) is 0.86 (0.85).

- $r_{i,t} - r_{m,t}$: annual market-adjusted returns for firm $i$ in fiscal $t$, computed by cumulating monthly market-adjusted returns. The market is the equally weighted index; returns

are inclusive of dividends and adjusted for stock splits.

- $Resilience^{FS}_{i,t-1}$: resilience to firm-specific shocks, calculated by estimating, for each firm $i$ and year $t$, a regression of $Earnings_{i,t-j}$ on $r_{i,t-j} - r_{m,t-j}$ during the 5 years preceding the sample year (i.e., $j = 1, 2, 3, 4, 5$) to obtain the slope coefficient on $r_{i,t-j} - r_{m,t-j}$. The absolute value of this slope coefficient is multiplied by $-1$ to give $Resilience^{FS}_{i,t}$.

- $Resilience^{MACRO}_{i,t-1}$: resilience to macro-economic shocks, calculated by estimating, for each firm $i$ and year $t$, a regression of $Earnings_{i,t-j}$ on $r_{m,t-j}$ (where $r_{m,t-j}$ is the equally weighted market index) during the 5 years preceding the sample year (i.e., $j = 1, 2, 3, 4, 5$) to obtain the slope coefficient on $r_{m,t-j}$. The absolute value of this slope coefficient is multiplied by $-1$ to give $Resilience^{MACRO}_{i,t}$.

- $Risk_{i,t-1}$: ranked ratio of risk from noise in earnings to risk from noise in returns. Risk from noise in earnings is the variance of earnings during the five years preceding $t$, while risk from noise in returns is the variance of monthly market-adjusted returns during the 60 months preceding $t$ (Lambert & Larcker, 1987).

- $Sales_{i,t-1}$: natural logarithm of sales at the end of $t-1$.

- $Sales'_{i,t-1}$: sales at the end of $t-1$, in million U.S.$.

- $Treatment_i$: an indicator variable that equals 1 if a firm is a treatment firm, and 0 if it is a control. A treatment firm is a sample firm that experiences a shock in $t-1$ (i.e., its annual market-adjusted return belongs to the decile of the most positive market-adjusted returns or to the decile of the most negative market-adjusted returns, across all sample firm-years), has information on CEO cash pay available in its proxy statements, and can be matched to a control firm. A control firm is a sample firm that experiences no shock in $t-1$ (i.e., its annual market-adjusted return belongs to the decile of the least positive market-adjusted returns or to the decile of the least negative market-adjusted returns, across all sample firm-years), and has information on CEO cash pay available in its proxy statements. Control firms are matched to treatment firms based on firm size (i.e., the $t-2$ market value of common equity) and on fiscal

year and 2-digit SIC code.

- $Volatility_{i,t-1}$: standard deviation of monthly stock returns, computed over the 60 months prior to $t$.

# References


Aggarwal, R. K., & Samwick, A. A. (1999). The other side of the trade-off: The impact of risk on executive compensation. *Journal of Political Economy*, *107*(1), 65–105.

Albuquerque, A. (2009). Peer firms in relative performance evaluation. *Journal of Accounting and Economics*, *48*(1), 69–89.

Baber, W. R., Kang, S.-H., & Kumar, K. R. (1998). Accounting earnings and executive compensation: The role of earnings persistence. *Journal of Accounting and Economics*, *25*(2), 169–193.

Baker, G. P., Gibbons, R., & Murphy, K. J. (1994). Subjective performance measures in optimal incentive contracts. *The Quarterly Journal of Economics*, *109*(4), 1125–1156.

Bertrand, M., & Mullainathan, S. (2001). Are CEOs rewarded for luck? The ones without principals are. *The Quarterly Journal of Economics*, 901–932.

Bushman, R. M., & Indjejikian, R. J. (1993). Accounting income, stock price, and managerial compensation. *Journal of Accounting and Economics*, *16*(1–3), 3–23.

Bushman, R. M., Indjejikian, R. J., & Smith, A. J. (1996). CEO compensation: The role of individual performance evaluation. *Journal of Accounting and Economics*, *21*(2), 161–193.

Core, J. E., Holthausen, R. W., & Larcker, D. F. (1999). Corporate governance, chief executive officer compensation, and firm performance. *Journal of Financial Economics*, *51*(3), 371–406.

Deckop, J. R. (1988). Determinants of chief executive officer compensation. *Industrial and Labor Relations Review*, *41*(2), 215–226.

Devers, C. E., Cannella, A. A., Jr, Reilly, G. P., & Yoder, M. E. (2007). Executive compensation: A multidisciplinary review of recent developments. *Journal of Management*, *33*(6), 1016–1072.

Faulkender, M., Kadyrzhanova, D., Prabhala, N., & Senbet, L. (2010). Executive compensation: An overview of research on corporate practices and proposed reforms. *Journal of Corporate Finance*, *22*, 107–118.

Gibbons, R., & Murphy, K. J. (1992). Optimal incentive contracts in the presence of career concerns: Theory and evidence. *Journal of Political Economy*, *100*(3), 468–505.

Gibbs, M., Merchant, K. A., Van der Stede, W. A., & Vargus, M. E. (2004). Determinants and effects of subjectivity in incentives. *The Accounting Review*, *79*(2), 409–436.

Greene, W. H. (2012). *Econometric analysis*. Upper Saddle River, NJ: Prentice Hall.

Hayes, R. M., & Schaefer, S. (2000). Implicit contracts and the explanatory power of top executive compensation for future performance. *Rand Journal of Economics*, *31*(2), 273–293.

Indjejikian, R. J., & Nanda, D. (2002). Executive target bonuses and what they imply about performance standards. *The Accounting Review*, *77*(4), 793–819.

Ittner, C. D., Larcker, D. F., & Meyer, M. W. (2003). Subjectivity and the weighting of performance measures: Evidence from a balanced scorecard. *The Accounting Review*, *78*(3), 725–757.

Lambert, R. A. (2001). Contracting theory and accounting. *Journal of Accounting and Economics*, *32*(1–3), 3–87.

Lambert, R. A., & Larcker, D. F. (1987). An analysis of the use of accounting and market measures of performance in executive compensation contracts. *Journal of Accounting Research*, *25*(Suppl.), 85–125.

Makri, M., Lane, P. J., & Gomez-Mejia, L. R. (2006). CEO incentives, innovation, and performance in technology-intensive firms: A reconciliation of outcome and behavior-based incentive schemes. *Strategic Management Journal*, *27*(11), 1057–1080.

Milgrom, P., & Roberts, J. (1992). *Economics, organization and management*. Englewood Cliffs, NJ: Prentice Hall.

Mitchell, M. L., & Mulherin, J. H. (1996). The impact of industry shocks on takeover and restructuring activity. *Journal of Financial Economics*, *41*(2), 193–229.

Moers, F. (2002). Discretion and bias in performance evaluation: The impact of diversity and subjectivity. *Accounting, Organizations and Society*, *30*(1), 67–80.

Murphy, K. J. (1999). Executive compensation. In A. Orley & D. Card (Eds.), *Handbook of labor economics* (Vol. 3, pp. 2485–2563). Amsterdam: Elsevier.

Murphy, K. J. (2000). Performance standards in incentive contracts. *Journal of Accounting and Economics*, *30*(3), 245–278.

Parametric Technology Corp. (2003). *Schedule 14A.* Needham, MA: Author.

Prendergast, C., & Topel, R. (1993). Discretion and bias in performance evaluation. *European Economic Review*, *37*(2–3), 355–365.

Raith, M. (2008). Specific knowledge and performance measurement. *Rand Journal of Economics*, *39*(4), 1059–1079.

Rajan, M. V., & Reichelstein, S. (2009). Objective versus subjective indicators of managerial performance. *The Accounting Review*, *84*(1), 209–237.

Royal Appliance MFG Co. (1994). *Schedule 14A.* Cleveland, OH: Author.

Sloan, R. G. (1993). Accounting earnings and top executive compensation. *Journal of Accounting and Economics*, *16*(1–3), 55–100.

Smith, C. W., & Watts, R. L. (1992). The investment opportunity set and corporate financing, dividend, and compensation policies. *Journal of Financial Economics*, *32*(3), 263–292.

Van der Stede, W. A. (2011). Management accounting research in the wake of the crisis: Some reflections. *European Accounting Review*, *20*(3), 605–624.

Table 1: Sample from 1992 to 2013

| | Firms | Firm-years |
|---|---|---|
| EXECUCOMP Data on annual CEO compensation | 3,268 | 36,920 |
| CEO has less than one year of tenure | (42) | (5,884) |
| | 3,216 | 31,036 |
| Multiple CEOs by firm and year | (10) | (241) |
| | 3,206 | 30,795 |
| Multiple firms by CEO and year | (6) | (142) |
| | 3,200 | 30,653 |
| No COMPUSTAT data on earnings before extraordinary items, and discontinued operations | (66) | (886) |
| | 3,134 | 29,767 |
| Less than 24 months of CRSP return data; fiscal year changes | (397) | (4,334) |
| | 2,737 | 25,433 |
| Annualized return data unavailable by fiscal year | (0) | (50) |
| Final sample, 1992–2013 | 2,737 | 25,383 |

This table shows the sample selection details between 1992 and 2013. Numbers in parentheses are observations that are dropped.

Table 2: Number of firm-specific shocks

| Number of Shocks (1) | Number of Firms (2) | Percentage of Firms (%) (3) |
|---|---|---|
| 0 | 789 | 28.8 |
| 1 | 587 | 21.5 |
| 2 | 431 | 15.8 |
| 3 | 301 | 11.0 |
| 4 | 250 | 9.1 |
| 5 | 137 | 5.0 |
| 6 | 106 | 3.9 |
| 7 | 71 | 2.6 |
| 8 | 30 | 1.1 |
| 9 | 18 | 0.7 |
| 10 | 9 | 0.3 |
| 11 | 5 | 0.2 |
| 12 | 1 | 0.1 |
| 14 | 2 | 0.1 |
| Total | 2,737 | 100 |

This table displays the number ('Number of Firms') and percentage ('Percentage of Firms') of firms that experience a different number of shocks ('Number of Shocks'). A shock occurs when a firm's annual market-adjusted return belongs to the decile of the most positive market-adjusted returns or to the decile of the most negative market-adjusted returns, across all sample firm-years.

Table 3: Descriptive statistics

| | Mean | St.Dev. | Minimum | 25 pctl | Median | 75 pctl | Maximum | Number of obs. |
|---|---|---|---|---|---|---|---|---|
| **CEO Pay** | | | | | | | | |
| Salary | 477,403 | 251,500 | 0 | 307,386 | 433,966 | 602,758 | 3,830,310 | 18,905 |
| Bonus | 359,625 | 1,037,750 | 0 | 0 | 88,099 | 396,839 | 50,549,560 | 18,905 |
| Cash Pay | 837,028 | 1,131,570 | 0 | 387,873 | 585,767 | 914,865 | 51,190,040 | 18,905 |
| Total Pay | 3,247,960 | 8,106,120 | 0 | 834,972 | 1,683,910 | 3,593,890 | 548,590,110 | 18,637 |
| $\frac{Bonus}{CashPay}$ | 0.26 | 0.26 | 0 | 0 | 0.21 | 0.48 | 1 | 18,831 |
| $\frac{CashPay}{TotalPay}$ | 0.46 | 0.29 | 0 | 0.21 | 0.40 | 0.67 | 1 | 18,623 |
| **Number of years since a shock** | | | | | | | | |
| $Number_{i,t}^{FS}$ of years since a *firm-specific* shock | 7.55 | 8.15 | 1 | 2 | 5 | 10 | 62 | 15,791 |
| $Number_{i,t}^{MACRO}$ of years since a *macro-economic* shock | 3.15 | 2.59 | 0 | 1 | 3 | 5 | 9 | 18,831 |
| **Firm Characteristics** | | | | | | | | |
| Earnings, $Earnings_{i,t}$ | 4.4% | 23.9% | –1,584.9% | 1.2% | 5.2% | 10.2% | 742.1% | 18,905 |
| Returns, $r_{i,t}$ | 5.2% | 48.6% | –244.5% | –21.1% | 1.9% | 26.9% | 447.6% | 18,905 |
| Size, $Sales'_{i,t-1}$ | 4,180 | 15,502 | 0 | 308 | 837 | 2,584 | 444,948 | 18,672 |
| Growth options, $BooktoMarket_{i,t-1}$ | 0.75 | 0.32 | 0.01 | 0.52 | 0.76 | 0.97 | 3.20 | 18,614 |
| Earnings $Risk_{i,t-1}$ | 0.51 | 0.29 | 0.00 | 0.27 | 0.51 | 0.76 | 1.00 | 16,371 |
| Earnings $Persistence_i$ | 0.71 | 0.46 | –3.06 | 0.38 | 0.68 | 1.02 | 4.39 | 18,878 |
| Return volatility, $Volatility_{i,t-1}$ | 0.13 | 0.07 | 0 | 0.09 | 0.12 | 0.16 | 0.73 | 18,753 |
| Resilience to firm-specific shocks, $Resilience_{i,t-1}^{FS}$ | –0.23 | 11.98 | –1,604.5 | –0.10 | –0.04 | –0.01 | 0 | 18,705 |
| Resilience to macro-economic shocks, $Resilience_{i,t-1}^{MACRO}$ | –0.28 | 4.66 | 381.6 | –0.16 | –0.06 | –0.02 | 0 | 18,705 |
| **CEO characteristics** | | | | | | | | |
| CEO tenure (years) | 8.9 | 7.8 | 1 | 3.3 | 6.4 | 11.75 | 60.7 | 18,905 |
| CEO is chairman | 0.56 | 0.50 | 0 | 0 | 1 | 1 | 1 | 18,905 |
| CEO is interlocked | 0.04 | 0.21 | 0 | 0 | 0 | 0 | 1 | 18,905 |

This table displays selected statistics for the 2,737 sample firms between 1992 and 2013. 'Cash Pay' is the sum of bonus and salary. 'Total Pay' includes cash pay; other annual pay (e.g., gross-ups for tax liabilities, perquisites, preferential discounts on stock purchases); long-term incentive payouts; all other compensation (e.g., payouts for stock option cancelation, 401K contributions, signing bonuses, tax reimbursements); the value of restricted stock granted during the year, determined at grant date; and the value of stock option grants, estimated using Black-Scholes. CEO pay data is in 1992 U.S. dollars. Sales is in million U.S. dollars. 'CEO Tenure' is the number of years between the time the CEO is appointed and the sample year. 'CEO is chairman' is an indicator variable that is 1 when the CEO chairs the board of directors, and 0 otherwise. 'CEO is interlocked' is an indicator variable that is 1 when the CEO is in an interlocking relationship, and 0 otherwise. $Number_{i,t}^{FS}$ is the number of years since the last firm-specific shock occurred, up until $t$; $Number_{i,t}^{MACRO}$ is the number of years since the last macro-economic shock occurred, up until $t$. All variables are defined in Appendix B.

Table 4: Number of years $Number_{i,t}^{FS}$ since the last firm-specific shock occurred and the sensitivity of CEO cash pay to earnings

| Independent variable | Predicted sign | (1) | (2) | (3) |
|---|---|---|---|---|
| $Earnings_{i,t}$ | +/– | 0.066 | 0.188 | 0.132 |
| | | (1.37) | (1.12) | (0.80) |
| $\mathbf{Earnings_{i,t}Number_{i,t}^{FS}}$ | + | **0.017**** | | **0.016**** |
| | | **(2.38)** | | **(2.30)** |
| $Earnings_{i,t}CEOTenure_{i,t}$ | +/– | | 0.112* | 0.106 |
| | | | (1.68) | (1.63) |
| $Earnings_{i,t}BooktoMarket_{i,t-1}$ | +/– | | –0.173*** | –0.171*** |
| | | | (–2.77) | (–2.65) |
| $Earnings_{i,t}Risk_{i,t-1}$ | – | | –0.428*** | –0.415*** |
| | | | (–3.17) | (–2.94) |
| $Earnings_{i,t}Persistence_{i}$ | + | | 0.290*** | 0.279*** |
| | | | (3.37) | (3.72) |
| $Number_{i,t}^{FS}$ | +/– | –0.004*** | | –0.003** |
| | | (–3.27) | | (–2.25) |
| $CEOTenure_{i,t}$ | + | 0.080*** | 0.095*** | 0.076*** |
| | | (7.06) | (7.04) | (6.09) |
| $BooktoMarket_{i,t-1}$ | +/– | –0.408*** | 0.472*** | –0.438*** |
| | | (–16.48) | (–18.82) | (–18.18) |
| $Risk_{i,t-1}$ | +/– | | –0.074*** | –0.027 |
| | | | (–2.99) | (–1.15) |
| $Persistence_{i}$ | +/– | | –0.276 | –0.700*** |
| | | | (–1.05) | (–4.54) |
| $r_{i,t} - r_{m,t}$ | + | 0.138*** | 0.152*** | 0.145*** |
| | | (16.22) | (18.26) | (16.64) |
| $Sales_{i,t-1}$ | + | 0.041*** | 0.007 | 0.007 |
| | | (3.68) | (0.47) | (0.75) |
| $Volatility_{i,t-1}$ | +/– | 0.548*** | 0.487*** | 0.524*** |
| | | (3.96) | (3.01) | (3.95) |
| $CEOChair_{i,t}$ | + | 0.111*** | 0.114*** | 0.117*** |
| | | (7.82) | (7.74) | (7.58) |
| $InterlockedCEO_{i,t}$ | + | 0.125*** | 0.066* | 0.095** |
| | | (3.31) | (1.80) | (2.31) |
| Adjusted $R^2$ | | 9.37% | 12.73% | 14.80% |
| # of observations | | 15,350 | 15,923 | 13,683 |

This table reports the results from estimating OLS regressions between 1992 and 2013 in the pooled cross-section with fiscal year and CEO fixed effects. The dependent variable is $CEOCashPay_{i,t}$, the natural logarithm of CEO cash pay (salary plus bonus pay) of the CEO of firm $i$ in fiscal year $t$. $Earnings_{i,t}$ is income before extraordinary items and discontinued operations scaled by lagged total assets. $Number_{i,t}^{FS}$ is the number of years since the last firm-specific shock occurred, until (and including) $t$. A firm-specific shock occurs when a firm's annual market-adjusted return belongs to the decile of the most positive market-adjusted returns or to the decile of the most negative market-adjusted returns, across all years between 1950 and 2012, for all sample firms. All variables are described in Appendix B. $t$-statistics (reported in parentheses) are based on standard errors clustered by firm and are robust to heteroscedasticity. ***, **, * indicate significance levels for two-tailed tests at the 1%, 5%, 10% level, respectively.

Table 5: Implications of macro-economic shocks and of resilience to shocks for the sensitivity of CEO cash pay to earnings

| Variable | Sign | (1) | (2) | (3) | (4) |
|---|---|---|---|---|---|
| $Earnings_{i,t}$ | +/– | 0.181 | 0.184 | 0.132 | 0.122 |
| | | (1.26) | (1.28) | (0.80) | (0.74) |
| $\mathbf{Earnings_{i,t}Number_{i,t}^{MACRO}}$ | + | **0.052*** ** | **0.053*** ** | | |
| | | **(5.58)** | **(5.69)** | | |
| $\mathbf{Earnings_{i,t}Resilience_{i,t-1}^{MACRO}}$ | +/– | | **0.007** | | |
| | | | **(0.77)** | | |
| $\mathbf{Earnings_{i,t}Number_{i,t}^{FS}}$ | + | | | **0.016**** | **0.019**** |
| | | | | **(2.30)** | **(2.56)** |
| $\mathbf{Earnings_{i,t}Resilience_{i,t-1}^{FS}}$ | +/– | | | | **0.16*** |
| | | | | | **(1.93)** |
| $Number_{i,t}^{MACRO}$ | +/– | 0.040*** | 0.040*** | | |
| | | (25.80) | (25.70) | | |
| $Resilience_{i,t-1}^{MACRO}$ | +/– | | –0.001 | | |
| | | | (–0.74) | | |
| $Number_{i,t}^{FS}$ | +/– | | | –0.003** | –0.004*** |
| | | | | (–2.25) | (–2.87) |
| $Resilience_{i,t-1}^{FS}$ | +/– | | | | 0.014 |
| | | | | | (1.12) |
| Adjusted $R^2$ | | 20.44% | 20.48% | 14.80% | 14.86% |
| # of observations | | 21,202 | 21,147 | 13,683 | 13,683 |

This table reports the results from estimating OLS regressions between 1992 and 2013 in the pooled cross-section with fiscal year and CEO fixed effects. The analysis includes all control variables used in Table 4 for the sensitivity of CEO cash pay to earnings and for the level of CEO cash pay, but does not display these variables. The dependent variable is $CEOCashPay_{i,t}$, the natural logarithm of CEO cash pay (salary plus bonus pay) of the CEO of firm $i$ in fiscal year $t$. $Earnings_{i,t}$ is income before extraordinary items and discontinued operations scaled by lagged total assets. $Number_{i,t}^{FS}$ [$Number_{i,t}^{MACRO}$] is the number of years since the last firm-specific [macro-economic] shock occurred up until (and including) $t$, in columns (1) and (2) [(3) and (4)]. A firm-specific shock occurs when a firm's annual market-adjusted return belongs to the decile of the most positive market-adjusted returns or to the decile of the most negative market-adjusted returns, across all years between 1950 and 2012, for all sample firms. A macro-economic shock occurs in the first year of an expansion or a recession period, identified using data from the National Bureau of Economic Research (NBER). In the vicinity of the sample period (i.e., 1992–2013), the NBER defines three recession periods (i.e., July 1990–March 1991, March 2001–November 2001, and December 2007–June 2009) and three expansion periods (i.e., March 1991–March 2001, November 2001–December 2007, and from June 2009 onwards). For the three recession [expansion] periods, the years of macro-economic shocks are 1990, 2001, and 2007 [1991, 2001, and 2009]. $Resilience_{i,t-1}^{FS}$ [$Resilience_{i,t-1}^{MACRO}$] captures resilience to firm-specific [macro-economic] shocks. All variables are described in Appendix B. $t$-statistics (reported in parentheses) are based on standard errors clustered by firm and are robust to heteroscedasticity. ***, **, * indicate significance levels for two-tailed tests at the 1%, 5%, 10% level, respectively.

Table 6: Univariate statistics for treatment and control firms

A. Use of subjective performance evaluation (SPE)

| | | Treatment firms | | Control firms | | $\chi^2$ |
|---|---|---|---|---|---|---|
| | | # | % | # | % | |
| | | (1) | (2) | (3) | (4) | (5) |
| $t-1$ | use SPE | 234 | 66.3 | 229 | 64.9 | 0.16 |
| | do not use SPE | 119 | 33.7 | 124 | 35.1 | |
| | Total | 353 | 100.0 | 353 | 100.0 | |
| $t$ | use SPE | 247 | 70.0 | 211 | 59.8 | 8.06*** |
| | do not use SPE | 106 | 30.0 | 142 | 40.2 | |
| | Total | 353 | 100.0 | 353 | 100.0 | |

B. Number of performance measures used subjectively

| | Treatment firms | Control firms | Difference |
|---|---|---|---|
| | (1) | (2) | (3) |
| $t-1$ | 1.85 | 1.80 | 0.05 |
| $t$ | 2.16 | 1.52 | 0.64*** |
| Difference | 0.31 | –0.28 | 0.59*** |

C. Firm and CEO characteristics, in year $t$ after the shock

| | Treatments | Controls | Difference |
|---|---|---|---|
| | (1) | (2) | (3) |
| Growth options, $BooktoMarket_{i,t-1}$ | 0.72 | 0.80 | –0.08*** |
| Risk, $Volatility_{i,t}$ | 0.20 | 0.15 | 0.05*** |
| Size, $Sales'_{i,t}$, in million U.S.$ | 2,098.2 | 2,643.8 | –460** |
| Losses, $Loss_{i,t}$ | 0.353 | 0.188 | 0.16*** |
| CEO tenure, $CEOTenure_{i,t}$, in years | 8.9 | 6.8 | 0.38 |

This table shows univariate statistics for the 353 treatment and 353 control firms between 1993 and 2012. Panel A compares the number and percentage (%) of treatment firms that use or do not use subjective performance evaluation with the number and percentage of control firms that use or do not use subjective performance evaluation. Panel B compares the average number of performance measures that treatment firms use in subjective performance evaluation in $t-1$ and $t$ with those that control firms use. The column 'Difference' shows the average difference in the number of performance measures between treatment and control firms. The row 'Difference' shows the average difference in the number of performance measures between $t-1$ and $t$. Panel C displays firm and CEO characteristics for treatment and control firms in the year after the shock. The column 'Difference' shows the average difference between treatment and control firms. A treatment firm is a sample firm that experiences a shock in $t-1$ (i.e., its annual market-adjusted return belongs to the decile of the most positive market-adjusted returns or to the decile of the most negative market-adjusted returns, across all sample firm-years), has information on CEO cash pay available in its proxy statements, and can be matched to a control firm. A control firm is a sample firm that experiences no shock in $t-1$ (i.e., its annual market-adjusted return belongs to the decile of the least positive market-adjusted returns or to the decile of the least negative market-adjusted returns, across all sample firm-years), and has information on CEO cash pay available in its proxy statements. Control firms are matched to treatment firms based on $t-2$ market values of common equity and 2-digit SIC codes. In Panel A, the $\chi^2$-test compares the frequencies of controls that report using subjective performance evaluation and those that do not report using it, with the frequencies of treatment firms that report using subjective performance evaluation and those that do not report using it, in $t-1$ and in $t$. In Panels B and C, the significance level for the 'Difference' is for a Student's $t$–test of the null that the difference in the number of performance measures is not different from zero, evaluated using matched pairs. All variables are defined in Appendix B. ***, **, * indicate significance levels at the 1%, 5%, 10% level, respectively.

Table 7: Increase in the use of subjective CEO performance evaluation

| Independent variable | Predicted sign | (1) | (2) | (3) |
|---|---|---|---|---|
| Intercept | +/– | –1.69*** | –2.02*** | –2.08*** |
| | | (–12.32) | (–3.60) | (–3.66) |
| **Treatment$_i$** | + | **0.320*** | | **0.341**** |
| | | **(1.91)** | | **(2.04)** |
| $BooktoMarket_{i,t}$ | +/– | | 0.394 | 0.426* |
| | | | (1.55) | (1.72) |
| $Volatility_{i,t}$ | – | | 0.700 | 0.102 |
| | | | (0.68) | (0.10) |
| $Sales_{i,t}$ | + | | 0.046 | 0.039 |
| | | | (0.78) | (0.69) |
| $Loss_{i,t}$ | + | | 0.152 | 0.092 |
| | | | (0.83) | (0.50) |
| $CEOTenure_{i,t}$ | + | | –0.128 | –0.124 |
| | | | (–1.07) | (–1.06) |
| $QIC$ | | 340.4 | 342.1 | 339.5 |
| # of observations | | 706 | 670 | 670 |

This table reports the results from estimating probit regressions for 353 treatment and 353 control firms between 1992 and 2013 in the pooled cross-section. The dependent variable is $IncreaseUse_{i,t-1,t}$, an indicator variable that equals 1 if, between $t-1$ and $t$, a firm increases the use of subjective performance evaluation, and 0 otherwise. $Treatment_i$ is an indicator variable that equals 1 if a firm is a treatment firm, and 0 if a firm is a control. A treatment firm is a sample firm that experiences a shock in $t-1$ (i.e., its annual market-adjusted return belongs to the decile of the most positive market-adjusted returns or to the decile of the most negative market-adjusted returns, across all sample firm-years), has information on CEO cash pay available in its proxy statements, and can be matched to a control firm. A control firm is a sample firm that experiences no shock in $t-1$ (i.e., its annual market-adjusted return belongs to the decile of the least positive market-adjusted returns or to the decile of the least negative market-adjusted returns, across all sample firm-years), and has information on CEO cash pay available in its proxy statements. Control firms are matched to treatment firms based on $t-2$ market values of common equity and 2-digit SIC codes. All variables are defined in Appendix B. $QIC$ captures goodness of fit and can be used to compare models; the model with the smaller $QIC$ is preferable. $Z$-statistics (in parentheses) are computed with robust standard errors clustered by firm. ***, **, * indicate significance levels for two-tailed tests at the 1%, 5%, 10% level, respectively.

Table 8: Increase in the number of performance measures used in subjective CEO performance evaluation

| | | Performance measures | | | |
|---|---|---|---|---|---|
| Independent Variable | Predicted Sign | All (1) | Non-financial (2) | Financial (3) | Individual (4) |
| Intercept | +/– | –1.062** | –1.700*** | –2.131** | –1.662*** |
| | | (–2.42) | (–3.25) | (–3.57) | (–2.42) |
| **$\mathbf{Treatment_i}$** | + | **0.460*** ** | **0.538*** ** | **0.325*** | **–0.123** |
| | | **(3.57)** | **(3.61)** | **(1.78)** | **(–0.73)** |
| $BooktoMarket_{i,t}$ | +/– | 0.354* | 0.180 | 0.250 | 0.503* |
| | | (1.82) | (0.83) | (1.17) | (1.91) |
| $Volatility_{i,t}$ | – | –0.590 | –0.530 | 0.634 | –0.282 |
| | | (–0.61) | (–0.51) | (0.68) | (–0.30) |
| $Sales_{i,t}$ | + | –0.024 | 0.029 | 0.030 | 0.039 |
| | | (–0.52) | (0.50) | (0.51) | (0.58) |
| $Loss_{i,t}$ | + | –0.153 | –0.162 | 0.151 | –0.021 |
| | | (–1.00) | (–0.97) | (0.75) | (–0.08) |
| $CEOTenure_{i,t}$ | + | –0.047 | 0.033 | 0.022 | –0.182 |
| | | (–0.55) | (0.34) | (0.22) | (–1.50) |
| $QIC$ | | 630.9 | 512.5 | 403.9 | 362.6 |
| # of observations | | 670 | 670 | 670 | 670 |

This table reports the results from estimating probit regressions for 353 treatment and 353 control firms between 1992 and 2013 in the pooled cross-section. The dependent variable is $IncreaseNum_{i,t-1,t}$, an indicator variable that equals 1 if, between $t-1$ and $t$, a firm increases the number of performance measures used in subjective performance evaluation, and 0 otherwise. $Treatment_i$ is an indicator variable that equals 1 if a firm is a treatment firm, and 0 if a firm is a control. A treatment firm is a sample firm that experiences a shock in $t-1$ (i.e., its annual market-adjusted return belongs to the decile of the most positive market-adjusted returns or to the decile of the most negative market-adjusted returns, across all sample firm-years), has information on CEO cash pay available in its proxy statements, and can be matched to a control firm. A control firm is a sample firm that experiences no shock in $t-1$ (i.e., its annual market-adjusted return belongs to the decile of the least positive market-adjusted returns or to the decile of the least negative market-adjusted returns, across all sample firm-years), and has information on CEO cash pay available in its proxy statements. Control firms are matched to treatment firms based on $t-2$ market values of common equity and 2-digit SIC codes. All variables are defined in Appendix B. $QIC$ captures goodness of fit and can be used to compare models; the model with the smaller $QIC$ is preferable. $Z$-statistics (in parentheses) are computed with robust standard errors clustered by firm. ***, **, * indicate significance levels for two-tailed tests at the 1%, 5%, 10% level, respectively.