Making the Same Mistake All Over Again:

CEO Overconfidence and Corporate Resistance to Corrective Feedback

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May 13, 2014

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ABSTRACT

Firms often make mistakes, from simple manufacturing overruns all the way to catastrophic blunders. However, there is considerable heterogeneity in the nature of corporate responses when faced with evidence that an error has taken place, and, therefore, in the likelihood that such errors will reoccur in the future. In this paper, we explore an important but understudied influence on firms' responses to corrective feedback – a CEO's level of overconfidence. Using multiple distinct measures of overconfidence and the empirical context of voluntary corporate earnings forecasts, we find strong, robust evidence that firms led by overconfident CEOs are less responsive to corrective feedback in improving management forecast accuracy. We further show that this relationship is moderated by prior forecast error valence, time horizon, and managerial discretion.

Keywords: *CEO overconfidence, Corrective feedback, Strategic decision making, Management forecast accuracy, Managerial cognition*

Firms receive a wide range of quantitative and qualitative feedback from markets, customers, employees, and other stakeholders. Some of this feedback supports and reinforces the decisions made by a firm. For example, product sales increases, regulatory approvals, and increased employee satisfaction are all indications that the firm is meeting or exceeding expectations (Koys, 2001). Some types of feedback, though – such as media stigmatization, forced product recalls, high employee turnover, and declining sales – suggest strategic and/or operational errors on the part of the firm, and therefore tend to provoke some type of corrective response (Baron, Hannan, and Burton, 2001; Barr, Stimpert, and Huff, 1992). For instance, Martins (2005) found that graduate business schools experiencing large discrepancies between externally-generated reputational rankings (e.g., the Business Week MBA rankings) and internal self-assessments of reputation tended to engage in large amounts of organizational change (also see Corley and Gioia, 2000; Fombrun and Shanley, 1990; Rindova and Fombrun, 1999).

However, both academic research and the popular press reveal considerable heterogeneity in the nature and extent of different firms' responses to corrective feedback. Some firms deal with product recalls by fundamentally overhauling production processes, while others make far more superficial changes (Davidson and Worrell, 1992; Voreacos, Nussbaum, and Farrell, 2011). Some firms respond to declining product sales via substantial investments in research and development, while others do little (Hambrick, MacMillan, and Barbosa, 1983; Reinhardt and Ihlwan, 2005). And, some firms address prolonged periods of corporate stagnation via widespread employee downsizing, while others make far less aggressive moves (Boyle, 2009; Datta *et al*., 2010).

Most of the work in the broader management field that informs our understanding of responses to corrective feedback largely focuses on contextual and firm-level influences, such as environmental dynamism (Haveman, 1992; Levinthal, 1997), strategic choice patterns (Hrebiniak

and Joyce, 1985; Raisch and Birkinshaw, 2008), and internal control and governance systems (Daft and Macintosh, 1984). However, little work has considered the characteristics of the senior-most decision makers in a firm. We address this omission and thereby build on the core insight of strategic leadership research – that the firm is a reflection of its top managers (Hambrick and Mason, 1984) – to better understand why some firms respond differently than others when faced with evidence of prior errors. Specifically, we examine the impact of one highly influential individual difference: a CEO's level of overconfidence.

Overconfidence, one of the most widely studied cognitive biases, refers to the extent to which individuals tend to overestimate the accuracy of their knowledge and judgments (Griffin and Tversky, 1992; Klayman *et al*., 1999).[1] A growing body of work has begun to consider the effects of this construct in senior executives. For example, CEO overconfidence has been associated with a propensity toward risky product introductions (Simon and Houghton, 2003) and firm innovation (Hirshleifer, Low, and Teoh, 2012). Most of this work in the executive realm has tended to equate overconfidence with optimism (the belief that events will unfold favorably). In other words, overconfident CEOs tend to expect positive outcomes (Hribar and Yang, 2013).

Although this is true, and overconfident individuals do indeed tend to be generally optimistic, an underexplored aspect of executive overconfidence is the 'miscalibration effect' (Grinblatt and Keloharju, 1999). In statistical terms, overconfident individuals place irrationally narrow 'error bars' around an estimate or prediction (Bazerman, 1986; Rovenpor, 1993). Thus, although we commonly see the situation where an overconfident executive is highly certain that a particular event (say, a change in government policy favoring industry incumbents) will have a

[1] Authors in the organizational literature generally treat executive overconfidence and hubris as being synonymous constructs with similar outcomes (Hill, Kern, and White, 2012). However, some studies identify distinctions in the antecedents and/or measurement of overconfidence and hubris (e.g., Hayward, Rindova, and Pollock, 2004). We discuss these distinctions, and their implications for our study, in more detail below.

preferred outcome, it is also possible that the same individual could simultaneously be highly certain that another event (say, a general strike or market collapse) will impact a firm adversely.

In turn, we argue that an executive's level of overconfidence will impact how he or she interprets feedback showing that events did not in fact unfold as originally predicted. Building on psychological research into self-attribution biases (Kelley, 1973; Langer and Roth, 1975), we develop theory arguing that overconfident executives – when faced with evidence of previous decision making errors (i.e., corrective feedback) – will be more likely to attribute the sources of these errors to external, idiosyncratic factors and bad luck, rather than to internal, systematic factors, such as poor decision-making processes or incompetence. Overconfident executives will therefore be more likely to ignore corrective feedback and will incorporate less information from prior feedback into their future decisions. We explicate our core arguments via four related hypotheses within the empirical context of voluntary management earnings forecasts (Hirst, Koonce, and Venkataraman, 2008). Using a 15-year sample of the career forecasting behavior of over 300 individual CEOs, we provide robust evidence that CEO overconfidence is negatively associated with improvement in management forecast accuracy over time. Put simply, overconfident executives who make mistakes continue to be wrong for longer.

Our study makes several important contributions to the strategic management literature. First, we develop new theory on the micro-foundations of firm-level strategic behavior (Felin and Foss, 2005), and particularly firm-level responses to corrective feedback. Second, we extend the existing literature on the impact of CEO overconfidence. Prior research in this domain has focused on specific firm-level outcomes of overconfidence (e.g., M&A, investment decisions). However, it is clear that most strategic decisions are not singular, stand-alone events, but are instead impacted by feedback ensuing from similar decisions made previously. Thus, we provide evidence as to why

certain firms might be associated with similar patterns of behavior, and especially similar mistakes, over time. Third, we make a significant empirical contribution by testing our hypotheses using three separate, established measures of overconfidence drawn from prior literature. Finally, by identifying the relative importance of boundary conditions associated with the impact of CEO overconfidence, we provide actionable knowledge for corporate boards tasked with overseeing and reacting to the decisions of overconfident CEOs.

RESEARCH CONTEXT: MANAGEMENT EARNINGS FORECASTS

We examine the concept of corrective feedback via the context of voluntary corporate earnings forecasts, also known as management forecasts (Benner, 2010; Bromiley, 1991). These forecasts are estimates of future annual or quarterly earnings per share (in our study we focus on annual forecasts). Firms are not legally required to issue management forecasts, but they provide a powerful way for firms to establish a reputation for transparent, timely, and accurate reporting (Hirst *et al*., 2008; Ramnath, Rock, and Shane, 2008). In our study, we examine how a firm responds when faced with evidence that a prior management forecast was materially inaccurate.

This research context has several major benefits. First, CEOs are directly responsible for the management forecasts issued by their firms. Although other senior executives (especially the Chief Financial Officer) are also usually involved, an annual earnings forecast is such a strategically and financially important announcement that the firm's CEO will have the ultimate responsibility for the accuracy of the forecast (Baginski, 1987; Chen, Chen, and Cheng, 2008). Second, firms cannot precisely know the accuracy of their forecasts at the time they are issued. Although there is usually an immediate market reaction to the forecast, it is only once actual earnings are released (anywhere from one to eleven months later) that market participants can evaluate the accuracy of the forecast. Third, compared to more ambiguous feedback, such as a

declining corporate reputation, a forecast error is discrete, measureable, and unequivocal. Finally, although managers may at times have some incentive to misrepresent earnings expectations (Noe, 1999; Rogers and Stocken, 2005), forecasting errors in general – both positive and negative – tend to be harmful to CEOs' careers and associated with reductions in firm value (Graham, Harvey, and Rajgopal, 2005; Lee, Matsunaga, and Park, 2012). Forecasting accuracy is therefore a voluntary, but powerful, mechanism by which CEOs and firms build positive reputations in capital markets (Graham *et al*., 2005; Williams, 1996; Yang, 2012).

THEORY AND HYPOTHESES

CEO overconfidence

Humans view the world encumbered by a series of cognitive biases (Kahneman and Tversky, 2000). One of the most ubiquitous of these biases is overconfidence, which may be defined as 'the tendency of individuals to overestimate their abilities' (Hill *et al*., 2012: 188). Overconfidence has two major components (Grinblatt and Keloharju, 1999). First, and most widely studied, is the 'better-than-average' effect. Evidence suggests that most individuals believe their skills, capabilities, and endowments – from intelligence and attractiveness to driving ability and likelihood of career success – are superior to the average person's (e.g., Harrison and Shaffer, 1994; Svenson, 1981; Taylor and Brown, 1994; Weinstein, 1980). Second, as we examine in this paper, overconfidence also includes a 'miscalibration' effect. When asked how sure they are of their predictions concerning uncertain future states of the world, people tend to profess an unjustifiable degree of certainty (Bazerman, 1986; Fischhoff, Slovic, and Lichtenstein, 1977). Overconfidence also influences individuals' responses to past events. Most individuals, when they succeed at a task, or when their predictions are proven correct, tend to take the credit themselves. When they fail, though, or when their predictions are proven incorrect, they blame bad luck and

other unforeseeable factors. In other words, 'tails I win, heads it's chance' (Langer and Roth, 1975: 951). Similar to all cognitive biases, though, the extent and nature of overconfidence can vary substantially from one individual to the next (Klayman *et al*., 1999).

Researchers have begun to explore the implications of varying levels of overconfidence in senior corporate executives (e.g., Li and Tang, 2010; Galasso and Simcoe, 2011). CEO overconfidence has been linked with a range of outcomes, including a firm's acquisition frequency (Billett and Qian, 2008; Brown and Sarma, 2007), the size of acquisition premiums (Hayward and Hambrick, 1997; Malmendier and Tate, 2008), risky product introductions (Simon and Houghton, 2003), firm risk-taking in general (Roll, 1986), and distorted investment project selection (Malmendier and Tate, 2005). Overconfident CEOs also tend to overinvest in their own firms, valuing such stock more highly than the market does (Malmendier and Tate, 2005; 2008). In addition to its impact on how CEOs view uncertain future events, such as potential acquisitions (Malmendier and Tate, 2008), we argue that overconfidence will also impact how CEOs interpret feedback from prior events. In particular, a CEO's level of overconfidence will affect the extent to which his or her firm incorporates and responds to corrective feedback ensuing from prior errors.

Before discussing our theoretical arguments in detail, it is important to clarify several issues related to the construct of executive overconfidence, along with how we deal with these issues in our paper. The literature on overconfidence, although comprehensive, can at times be somewhat confusing due to inter-related differences in underlying terminology, assumptions, and measurement (Hill *et al*., 2012). First, as noted above, many authors treat the terms overconfidence and hubris as being synonymous, and tend to associate similar theoretical mechanisms with both (Hill *et al*., 2012). However, hubris is sometimes defined slightly differently (e.g., 'exaggerated pride or self-confidence, often resulting in retribution' (Hayward

and Hambrick, 1997: 106)). In addition, some work on hubris suggests that it is socially constructed, and often a function of an executive's recent successes, or 'believing one's own (good) press' (Hayward *et al*., 2004; Hayward, Shepherd, and Griffin, 2006).

Second, prior work is mixed as to whether overconfidence is more of an invariant trait or a time-varying state. Some studies assume that overconfidence is driven by dispositional variables such as self-efficacy (Bandura, 1977), and should therefore be operationalized as an individual-level fixed-effect (e.g., Brown and Sarma, 2007; Simon and Houghton, 2003). In contrast, other work assumes that overconfidence can vary over time, and should therefore be operationalized accordingly (e.g., Ahmed and Duellman, 2013; Mishina *et al*., 2010).

Third, a range of different measures have been used to operationalize overconfidence. These can broadly be grouped into four categories: 1) media-based reflective measures, usually based on a CEO's portrayal in the business press (e.g., Malmendier and Tate, 2008); 2) behavioral reflective measures based on a CEO's actions, such as executives' option-holding behavior or net purchases of the firm's own stock (e.g., Campbell *et al*., 2011; Hirshleifer *et al*., 2012); 3) survey-based measures, usually within populations of entrepreneurial or smaller firms (e.g., Simon and Houghton, 2003); and 4) formative measures, based on indicators of prior success, such as positive firm performance or media praise (e.g., Hayward and Hambrick, 1997). Measures from the first three groups are not based on the assumption that the executive is aware of, or directly influenced by, the measure itself. However, formative measures *are* based on the assumption that overconfidence, and the executive's subsequent behavior, is influenced by the measures.

In this study, we deal with these issues in the follow ways. First, we describe our core construct simply as overconfidence, as this term tends to be more widely used in the literature and our theory does not require the 'retribution' that is sometimes implied in definitions and

discussions of hubris (Hayward and Hambrick, 1997; Petit and Bollaert, 2012). Second, we assume that overconfidence may have both invariant (trait-based) and time-varying (state-based) components, and therefore examine both possibilities in our empirical analyses. Third, our theory does not require the assumption that executives' levels of overconfidence are influenced by prior successes, or that the executives are aware of the nature of media reports discussing them. However, to account for this possibility empirically, we use three distinct archival-based measures of overconfidence in our analyses (a media-based reflective measure, a behavioral reflective measure based on option holding, and a formative measure based on prior success).

CEO overconfidence and responses to corrective feedback

Although we do not suggest that CEOs are the only ones involved in making important firm-level decisions, evidence strongly indicates that senior executives are especially powerful in shaping and executing corporate strategic behavior (e.g., Finkelstein and Boyd, 1998; Wiersema and Bantel, 1992; Zhang and Rajagopalan, 2004). The upper echelons perspective in strategic management is based on the premise that executives' fields of vision, perceptions, and interpretive frames may differ substantially in line with concomitant differences in executives' personalities, cognitions, experiences, preferences, and characteristics (Carpenter, Geletkanycz, and Sanders, 2004; Hambrick and Mason, 1984). Thus, two firms may respond quite differently to an objectively identical event as a result of differing executive mindsets. A firm's response to corrective feedback will therefore be influenced by how that firm's CEO interprets such feedback. These unique interpretations will themselves be shaped by the CEO's distinct characteristics. In an uncertain environment, managers' personal judgment biases will influence their assessment of the source, magnitude, and tolerability of management forecast errors, and therefore the effectiveness of their original decisions leading to those errors. We therefore predict that CEOs will differ in

their attributions for, and responses to, inaccurate management forecasts.

Consider the hypothetical situation where a firm issues, at time *t1*, an earnings forecast of $2.00 per share for that fiscal year. Then, at time *t2* (one to eleven months later, depending on when the management forecast was issued), the firm reports actual earnings, which subsequently turn out to be $1.00 per share. This would therefore be described as an optimistic forecast with a forecast error of $1.00 (sometimes termed a negative forecast error). Further assume that most analysts agreed this discrepancy was mainly due to an unexpected reduction in demand following the launch of a competitor's product. How might different CEOs interpret these events?

There are three broad possibilities. One CEO might view events as being entirely their own fault – the firm's market intelligence system, which he or she is ultimately responsible for, failed to predict the emergence and success of the competitor product. A second CEO might feel partly responsible – although the firm should have been more acutely aware of industry developments, the CEO might also feel that it was impossible to predict how strongly the competitor product would resonate with a particular customer segment. A third CEO might attribute the blame entirely elsewhere – the firm knew all it needed to know about the competitor product, the forecast was constructed accurately, but there was a reduction in demand due to an unforeseeable change in economic climate that affected the focal firm's key markets more than its competitors. A similar set of possible interpretations can be envisioned for the hypothetical situation where actual earnings substantially exceeded the management forecast (a pessimistic forecast, also known as a positive forecast error). Some CEOs will believe that the forecast inaccuracy was entirely caused by internal shortcomings; some CEOs will attribute the discrepancy entirely to external, period-specific events; and some CEOs will fall somewhere in between.

We argue that a CEO's attributions when faced with such forecast errors will vary as a

function of their level of overconfidence. CEOs, like individuals generally, tend to display self-attribution biases, i.e., they are inclined to attribute favorable outcomes to their own decisions or actions, but unfavorable outcomes to external, unforeseeable factors or bad luck (Kahneman and Tversky, 2000). Thus, CEOs will generally tend to prefer external explanations of negative events. However, this will vary substantially depending on their level of overconfidence.

Building on prior literature, we theorize that overconfidence will manifest in stronger self-attribution biases via the following psychological mechanisms. First, high levels of overconfidence, and the concomitant increase in commitment to a predicted outcome, will significantly increase a CEO's ego involvement – the situation where a task or event is perceived to be a potential threat to important ego factors (e.g., self-esteem, status) (Utman and Harkins, 2010). Task performance is especially important to an individual experiencing high ego involvement. In turn, evidence suggests that self-attribution biases, especially self-protective biases, are stronger under conditions of high ego involvement (Miller, 1976).

Second, overconfident individuals overestimate their own acumen relative to that of others, and are more certain that their predictions will be accurate (Larwood and Whittaker 1977; Svenson 1981). When faced with unambiguous evidence that prior predictions were in fact incorrect, these individuals are likely to experience cognitive dissonance (Festinger, 1957; Starzyk *et al*., 2009). Dissonance arises when individuals experience inconsistencies among cognitive elements (i.e., a high level of certainty concerning a prediction along with evidence that the prediction was substantially incorrect), leading to psychological discomfort (Elliot and Devine, 1994). A common way that individuals resolve dissonance is to add a consonant cognitive element – something that allows the seemingly contradictory cognitive elements to logically co-exist (Festinger, 1957). 'Denial of responsibility' (Gosling, Denizeau, and Oberle, 2006), or blaming an

incorrect prediction on unforeseeable external factors, is a successful way to reduce dissonance. Thus, self-attribution biases are likely to be stronger when overconfidence is higher.

In sum, we argue that overconfidence will be associated with the way in which a CEO interprets the causality of prior feedback and, therefore, the CEO's subsequent response to that feedback. Overconfident CEOs will have little trouble attributing error to random, period-specific events that are unlikely to recur in the future, and will be far more unshakeable in their certainty that their contribution to the forecast generation process was not the source of the problem. Being more convinced that past inaccuracy was due to unforeseeable factors, overconfident CEOs will be more likely to ignore the corrective feedback and less likely to comprehensively examine the sources of prior forecast error. Thus, although overconfident CEOs might adjust their forecasting processes to some extent, this will be substantially limited. As a result, overconfident managers will show less improvement in forecasting accuracy from one time period to the next.

In contrast, less overconfident CEOs will be more likely to attribute causality for a forecast failure to internal (personal) sources vis à vis external factors. These CEOs, if they do decide to issue subsequent forecasts, will be particularly motivated to determine the sources of error in past forecasts. Attributing the failure relatively more to internal sources, they will take more time, and invest more resources, in order to develop better environmental scanning procedures and internal firm processes, such that they increase the likelihood of improving forecast accuracy in the future. In this group of managers, we expect to see greater improvement in forecasting accuracy over time. In summary, CEOs' self-attribution biases, derived from their levels of overconfidence, will influence the extent to which CEOs respond to corrective feedback, and, therefore, their firms' accuracy in subsequent management forecasts. Thus, we hypothesize:

> *Hypothesis 1: CEO overconfidence will be negatively related to the improvement of management forecasting accuracy from earlier to later periods.*

Forecast error valence

To this point, we have treated management forecast errors as a homogenous category. And, prior work does indeed suggest that boards of directors use management forecast accuracy as a signal of CEOs' managerial ability, with managers bearing significant costs for issuing inaccurate earnings forecasts in their career (Lee *et al*., 2012). Firms' reputations in the capital markets are also negatively affected by inaccurate earnings forecasts (Graham *et al*., 2005). Accordingly, CEOs will be incentivized to minimize forecasting errors in general. However, several streams of research suggest that errors are likely to have a differential impact depending on their valence, or whether prior forecast errors were optimistic or pessimistic.

First, a large literature has identified that, compared to pessimistic forecast errors, markets tend to penalize optimistic forecast errors more because the firm has failed to satisfy the market's expectations (e.g., Bartov, Givoly, and Hayn, 2012; Cotter, Tuna, and Wysocki, 2006). Although pessimistic forecasts also represent errors, the market is relatively more lenient in such cases because the firm has at least managed to 'meet or beat' expectations (e.g., Bartov *et al.*, 2002). Second, psychological and economic research persuasively demonstrates that negative events tend to be more salient to individuals than positive events (e.g., Anderson and Phelps, 2001; Fiske, 1980; Fiske and Taylor, 1991). For instance, prospect theory is based on the idea that losses are relatively more painful to an individual than gains are beneficial (Kahneman and Tversky, 1979; Rozin and Royzman, 2001). Thus, although any material forecast error will be perceived as a negative event, some types of errors, specifically optimistic forecasts, will be seen as more negative, and thus more salient, than others. CEOs should, in general, therefore be more likely to feel pressure to respond to corrective feedback arising from an earlier optimistic forecast.

If the prior forecast was optimistic, less overconfident managers, who are more likely to

assume personal responsibility for erroneous forecasts, will be especially likely to take the steps needed to improve accuracy. Overconfident managers, though, who tend to be naturally predisposed toward optimism (Hribar and Yang, 2013), are relatively less likely to be concerned and will more readily attribute the forecast error to unique, period-specific causes. In contrast, following a pessimistic forecast, a firm will tend to experience less market pressure because the firm will have at least beaten its prior forecast. Thus, differences in self-attribution biases between overconfident and less overconfident CEOs will be less pronounced following pessimistic forecasts. Therefore, we predict that CEO overconfidence will have a stronger impact on subsequent improvement of management forecast accuracy following prior optimistic forecasts.

> *Hypothesis 2: The negative relationship between CEO overconfidence and forecast accuracy improvement will be moderated by forecast error valence, such that there will be a stronger (more negative) effect of CEO overconfidence on subsequent improvement of management forecast accuracy if the prior forecast was optimistic.*

Contextual influences on self-attribution biases

Our core logic in this study is that overconfidence enhances CEOs' self-attribution biases, which will lead them to disproportionately attribute failures to external, unforeseeable events, thereby inhibiting forecast accuracy improvement. To further test this core logic, we examine the impact of CEO overconfidence in several situations where we can reasonably expect variability in the extent to which self-attribution biases are likely to occur. If our logic holds, we should see that the negative impact of CEO overconfidence on subsequent forecast accuracy improvement is amplified in those situations where the potential for self-attribution bias is stronger.

Attribution biases are influenced by contextual factors, such as the characteristics of bias-triggering events and the feedback ambiguity involved (e.g., Spilka, Shaver, and Kirkpatrick, 1985). When feedback is relatively more ambiguous, and the link between prior decisions and the feedback received is more tenuous, individuals assign less weight to such feedback when they

perform the task again (Einhorn and Hogarth, 1978; Kahneman and Tversky, 1973). Noisier feedback is more likely to induce external attribution biases and thus will have a relatively weaker impact on subsequent decisions. However, if feedback is largely unambiguous and there is a clearer causal link between prior actions and subsequent feedback, individuals have fewer reasons to attribute their prior errors to external factors. Accordingly, they will give more weight to such feedback when they perform the task again. In our study, we consider two important conditions – time horizon, or *when* the prior management forecast was issued, and managerial discretion, or the nature of the environment *where* the forecast was issued.

Time horizon. If the length of time between a prior management forecast and the release of actual earnings was short, CEOs will have few opportunities to blame forecast inaccuracies on random, unforeseeable events. Both overconfident and less overconfident CEOs are likely to feel similar levels of responsibility for a given degree of forecast inaccuracy. In turn, both should be associated with relatively similar levels of improvement in subsequent forecast error.

However, if the time horizon between an earnings forecast and the release of actual earnings was long, CEOs will – if they so choose – be able to generate a range of justifications for an inaccurate forecast that were unforeseeable at the time, such as macroeconomic shocks, changes in government policy, or product-market challenges by other firms. Overconfident CEOs, who feel more certain of their judgments, will be especially likely to take advantage of these opportunities to attribute failure to outside sources, and will therefore be especially likely to disregard the corrective feedback contained in the inaccurate forecast. Less overconfident CEOs, though, who will be innately more likely to accept personal responsibility for inaccurate forecasts, will be less likely to take advantage of the many external excuses on offer in a long time horizon situation. Accordingly, they will be more likely to make corrections to their forecasting practices and

processes, leading to greater forecast accuracy improvement. In summary, we hypothesize:

> *Hypothesis 3: The negative relationship between CEO overconfidence and forecast accuracy improvement will be moderated by the time horizon of the prior forecast, such that the longer the time horizon, the stronger (more negative) the effect of CEO overconfidence on forecast accuracy improvement.*

Managerial discretion. For related reasons, we argue that the impact of CEO overconfidence on subsequent management forecast improvement will also depend upon the different environmental conditions under which different firms operate. Managerial discretion, or latitude of executive action, refers to the extent to which CEOs have a broad or narrow range of strategic actions from which to choose (Finkelstein and Boyd, 1998; Hambrick and Finkelstein, 1987). In a high-discretion environment – such as the computer software industry – there are many choices, an absence of constraint, and large amounts of ambiguity between actions and outcomes. In a low-discretion environment – such as the electric utilities industry – change is slow and largely predictable, choices are few, and uncertainty is low.

We expect that low-discretion environments will also be associated with a lower likelihood of self-attribution biases occurring. In such environments – where change is gradual and rarely discontinuous, and yesterday is a strong guide to tomorrow – all CEOs, no matter their level of overconfidence, will have fewer opportunities to legitimately attribute inaccurate forecasts to external, unforeseeable events. Therefore, overconfident and less overconfident CEOs are both likely to show similar levels of improvement in forecast accuracy.

However, in high-discretion environments, self-attribution biases are more likely to occur. In such a context – where change is rapid, uncertainty is pervasive, and predictions are unreliable – inaccurate management earnings forecasts may be more easily attributable to unpredictable, period-specific causes. Overconfident CEOs, who have sustained faith in their judgments, will be especially likely to attribute forecast failure to unforeseeable events, and will therefore feel little

need to incorporate corrective feedback from a prior inaccurate forecast into their future forecasts. Less overconfident CEOs, though, who are predisposed toward accepting personal responsibility for decision-making errors, will be less likely to take advantage of the greater range of justifications available at hand. These CEOs are therefore more likely to adjust their forecasting models and thus improve their subsequent forecasting accuracy. In summary, we hypothesize:

> *Hypothesis 4: The negative relationship between CEO overconfidence and forecast accuracy improvement will be moderated by managerial discretion, such that the higher the level of discretion, the stronger (more negative) the effect of CEO overconfidence on forecast accuracy improvement.*

METHODS

Sample and data

We used the empirical context of voluntary management earnings forecasts in U.S. public firms to test our hypotheses. To ensure that all CEOs in our sample faced similar pressures to respond to corrective feedback, our sample consisted of all forecasts issued by CEOs whose very first forecasts were materially inaccurate. A CEO dealing with the aftermath of their first management forecast is going to be more uncertain of the cause of a material error, and will feel less established in their position. Therefore, whatever the actual cause of the error, the CEO is likely to experience strong pressure – from both external and internal sources – to not make such a mistake again. In contrast, if we take a CEO whose first few forecasts were relatively accurate, and who did not make a material error until, say, their third or fourth forecast, such an individual has a more comprehensive set of (successful) prior forecasting experiences to draw upon. Such a CEO is more likely to view a material error as being simply a one-off occurrence, because it was demonstrably out of the ordinary, and will therefore feel substantially less pressure. Restricting our sample to those CEOs who made materially inaccurate first forecasts thereby allows us to more effectively test the impact of CEO overconfidence on forecast accuracy improvement in a sample of CEOs

who all experienced pressure to respond to corrective feedback.[2] To create our initial sample, we used Execucomp to generate an initial list of public firm CEOs for the 15-year period from 1994 to 2008 inclusive. We then merged the company identifiers from Execucomp with the First Call database to obtain all annual management forecasts issued during these CEOs' tenures.[3]

Forecasting errors (the absolute difference between a management forecast and actual earnings) are inevitable in an uncertain business environment. However, material errors are especially consequential for CEOs and investors (Barron, Byard, and Young, 2008). Following prior research (e.g., Pfarrer, Pollock, and Rindova, 2010), we defined material forecast errors as those that fell in the top and bottom quartiles of forecast errors in a given industry in a given year, based on all the observations in the First Call database. Such an approach controls for differences in earnings volatility and performance expectations among the industries in our sample.[4]

We then retained the management forecasting history for all CEOs whose first forecasts were characterized by material errors (with some errors being optimistic and some being pessimistic). This process generated a total of 319 CEOs. Of these CEOs, 102 did not provide further forecasts during their tenures within the firm. We therefore tested our hypotheses using a

[2] To ensure the robustness of this sampling choice, we conducted a supplementary analysis using a more restrictive sample, which was comprised of forecasts from those CEOs whose first *two* forecasts were materially inaccurate (this procedure reduced our sample size to 96 observations). We continued to find largely consistent support for our hypotheses.

[3] A management earnings forecast can be in several forms: point (e.g., $1 per share), range (e.g., $0.90 - $1.10 per share), open-ended (e.g., greater than $0.90 per share), or qualitative (no numerical estimates). We used the exact value of point and open-ended forecasts, the midpoint for range forecasts, and omitted qualitative management forecasts (Anilowski, Feng, and Skinner, 2007; Cotter *et al*., 2006). We omitted earnings pre-announcements (management forecasts that are issued after the end of the fiscal year), because they are actually preliminary earnings announcements rather than forecasts (Skinner, 1997). If a firm issued more than one management forecast in a fiscal year, we used the last forecast prior to the fiscal year-end (e.g., Anilowski *et al*., 2007; Cotter *et al*., 2006; Hribar and Yang, 2013). Such an approach provides a more conservative test of our theory compared to using the first forecast issued in a year, because there should be greater uncertainty when managers issue their first forecasts in a year. As an additional robustness check, we re-ran our analyses using the earliest (rather than the last) management forecast issued after the earnings announcement of the prior year, for those years when CEOs issued multiple forecasts. Our results were qualitatively similar.

[4] In subsequent robustness tests, we found consistent results when we used the top and bottom 20th or 30th percentiles as the alternative cut-off points for material forecast errors.

final sample of 578 forecasts issued by the remaining 217 CEOs who continued to issue subsequent management forecasts in future periods (with two to seven forecasts per CEO). Because some CEOs chose not to issue subsequent forecasts following an initial materially inaccurate forecast, we controlled for potential selection biases in our empirical analyses.

Measures

Improvement of management forecasting accuracy. The dependent variable for all hypotheses was the improvement of management forecast accuracy from time *t-1* to time *t* (with $t \geq 2$). Management forecast error was operationalized as the absolute difference between the management-forecasted earnings and actual earnings, scaled by the share price at the beginning of the year (Feng, Li, and McVay, 2009; Williams, 1996). Improvement of management forecasting accuracy was therefore calculated as error at time *t* minus error at time *t-1*, multiplied by minus one. Thus, a positive value of this measure indicates improvement in forecast accuracy, while a negative value indicates deteriorating forecast accuracy.[5]

CEO overconfidence. Executive overconfidence has been operationalized in a number of different ways, in line with variations in assumptions concerning the nature of the construct in prior studies. Therefore, we used three separate measures of overconfidence, taken directly from prior literature, to test our hypotheses. In this way, we can ensure that the findings in our study are not being driven by the idiosyncrasies of any specific measure of CEO overconfidence. Our first measure, *overconfidence_media*, is an annual measure based on CEOs' portrayal in the media (Hirshleifer *et al*., 2012; Hribar and Yang 2013; Malmendier and Tate, 2008). This measure is based on the premise that media reports are a reflection of the underlying characteristics of the executive, but it

[5] For instance, if the management forecast were \$0.90 per share at time *t-1*, and the actual earnings were \$1.00 per share, the forecast error at time *t-1* would be \$0.10. During the same CEO's tenure, if the forecast error at time *t* were \$0.08, the improvement in forecast accuracy would be 0.02 [i.e., - (0.08-0.10)]. By contrast, if during the same CEO's tenure the forecast error at time *t* were \$0.11, improvement in forecast accuracy would be -0.01 [i.e., -(0.11-0.10)].

makes no assumption regarding whether or not the executive is actually aware of this media coverage. We first searched for all news articles referring to each of the CEOs in our sample in a range of major publications including *The New York Times, Business Week, the Financial Times, The Economist,* and the *Wall Street Journal*. For each CEO and each year, we determined the number of articles that referred to a CEO in 'confident' terms ('confident,' 'confidence,' 'optimism,' or 'optimistic') and the number of articles that referred to a CEO in 'non-confident' terms ('reliable,' 'cautious,' 'conservative,' 'practical,' 'frugal,' 'steady,' 'not confident,' or 'not optimistic').[6]

In the original measure developed by Malmendier and Tate (2008), a CEO was classified as overconfident in a given year if, in the period from entering office up to the prior year, the number of articles containing 'confident' descriptions ('confident articles') exceeded the number of articles containing 'non-confident' descriptions ('non-confident articles'). While this binary measure has been used in later studies (e.g., Hirshleifer *et al*., 2012), one potential weakness is that CEOs without any media coverage were classified in the non-overconfident group. A more recent study by Hribar and Yang (2013) modified this measure by operationalizing overconfidence as the difference between confident articles and non-confident articles, divided by total number of articles. In this measure, overconfidence is a continuous variable ranging from -1 to 1, with a higher value indicating greater overconfidence. This measure more effectively incorporates CEOs without media coverage, because these CEOs are assigned a zero value, which lies in the middle of the distribution. Our analyses are based on Hribar and Yang's (2013) modified measure.[7]

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[6] We only counted 'confident' or 'non-confident' terms if they appeared within ten words of the CEO's name. Initial coding was performed using an automated computer algorithm, and all terms were then checked manually to ensure that the term was being used to describe the CEO.

[7] In our sample, there was at least one news article available for 168 of the CEOs (77.4%). To address the possible concern that CEOs with no media coverage are fundamentally different, we also re-ran our analyses after omitting these CEOs. Although this reduced the number of observations, our additional analyses generated similar findings. Results are available upon request. In addition, we discuss below a series of further reliability and robustness tests of

Our second measure, *overconfidence_options*, is a binary measure based on CEOs' personal portfolio decisions (Campbell *et al*., 2011). This measure is based on the premise that CEOs who persistently postpone exercising in-the-money stock options are overconfident regarding the future prospects of the firm, compared to the market's evaluation of the firm (Jin and Kothari, 2006). A CEO was coded as being overconfident if, at least twice during the sample period, he or she continued to hold stock options that were more than 100% in-the-money (i.e., the stock price was greater than the exercise price by more than 100%). As in Campbell *et al*. (2011), we classified a CEO as being overconfident from the year when he or she first exhibited the behavior.

Our third measure, *overconfidence_success*, is a continuous annual measure based on an index of three antecedent variables that might influence a CEO's overconfidence: recent firm performance, media praise for the CEO, and CEO relative compensation (Hayward and Hambrick, 1997). This measure is based on the premise that overconfidence (hubris) is a situationally-enhanced characteristic that may be magnified by evidence that the CEO has succeeded in the past. In contrast to *overconfidence_media*, this measure assumes that the CEO is aware of this evidence, so it is formative rather than reflective. We followed Hayward and Hambrick (1997:113-114) in measuring each variable and created the overall measure using the sum of the standardized values of the three variables. Similar to the statistics reported by Hayward and Hambrick (1997), pairwise correlations among our three indicators were all positive and significant, and an exploratory factor analysis indicated that the three items loaded onto a single factor.

Prior forecast optimism. Prior forecast optimism was coded as one if the prior forecast (at time *t-1*) was greater than the actual earnings for the year, and zero otherwise.

Time horizon. Time horizon of the prior management forecast (at time *t-1*) was calculated as the log of the number of days between the management forecast date and the fiscal year-end date (e.g.,

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our *overconfidence_media* measure.

Feng *et al*., 2009). The earlier a forecast was issued, the greater the time horizon.

Managerial discretion. We used an index comprised of four different variables to operationalize managerial discretion (e.g., Hambrick and Abrahamson, 1995). Each of our measures was based on annual data at the 2-digit SIC industry level. *Capital intensity* was operationalized as the industry average of net value of property, plant, and equipment divided by the number of employees (Hambrick and Abrahamson, 1995; Hay and Morris, 1979). Because greater capital intensity is a reflection of lower managerial discretion, we reverse coded this variable. *Product differentiability* was operationalized as the industry average of research and development intensity, calculated as the total research and development expenses divided by total sales at the industry-level (cf. Scherer, 1980). Greater product differentiability is a reflection of greater managerial discretion. *Market munificence* was operationalized as the average growth in industry sales over the previous five years (Keats and Hitt, 1988; Li and Tang, 2010). Greater market munificence is a reflection of greater discretion. *Market concentration* was operationalized as the Herfindahl index of industry concentration (Aldrich, 1979). We reverse coded this variable so that higher values reflected higher levels of discretion. We then created an overall managerial discretion index *(MD index)* by standardizing and summing these four component measures.

Control variables. We controlled for a number of measurement-related, CEO-level, firm-level, and contextual factors that might influence management forecast accuracy. Our measurement-related controls included total *number of articles* written about the CEO, and *media tenor* (the percentage of the articles having a positive tone). We used the Linguistic Inquiry and Word Count (LIWC) software to code the tenor of an article (Pennebaker, Francis, and Booth, 2001). We coded an article as having a positive tenor if the positive affective content of the article was at least 75 percent of its total affective content (Pfarrer *et al*., 2010). Media tenor was measured as the sum of

the number of positive articles divided by the total number of articles.

Our CEO-level controls included: *CEO incentive structure* (stock-based pay as a percentage of total compensation for the firm-year); *CEO duality* (a dummy variable equal to one if the CEO was also board-chair in the firm-year), and *CEO tenure* (in years)

Our firm-level controls included: *firm size (*natural log of total assets); *sales growth*; *firm beta* (reflecting firm-level risk, operationalized by the slope coefficient from estimating Sharpe's (1964) market model using daily return data from the previous year); *earnings volatility* (standard deviation of quarterly return on assets in the past three years); *bad news* (a dummy variable indicating whether the current management forecast contained bad news about the firm; it was coded as one if the forecasted earnings was lower than the most recent analyst consensus forecast, and zero otherwise), *firm diversification* (an entropy measure of diversification, which captures both the extent and the relatedness of diversification across a firm's activities (Palepu, 1985)), *number of analysts* following the firm, and *outside director ratio* (number of outside directors divided by board size). Finally, we included the total *number of management forecasts* issued for each firm-year to control for management forecast frequency.

Model specification

To test our hypotheses, we used a panel comprised of all management forecasts that our sample CEOs issued subsequent to their first forecasts, over the course of their tenures as CEO. Such panel data contains repeated observations for each CEO/firm, with observations being both cross-sectionally and time-serially correlated. To address these two different forms of dependence in our data, we used fixed effect models, including fixed firm effects and fixed year effects for our analyses (the results of the Hausman test rejected the null hypothesis of a random effect model with $\chi^2 > 82$ in all models at the $p<0.001$ level). Robust standard errors were adjusted at the

individual CEO level for all coefficient estimates in our analyses (e.g., Brochet, Faurel, and McVay, 2011).[8] To test H2-H4, we created interaction terms by multiplying our measure of CEO overconfidence by prior forecast optimism, time horizon, and managerial discretion. All interaction terms were mean-centered. Our hypotheses predict that each of the interaction coefficients will be negatively significant.

Correction for potential selection bias. Our sample comprised the career forecasts of those CEOs whose first forecasts for their firms contained material errors, and who also subsequently issued one or more management forecasts in later years. Such a sample is subject to self-selection bias as it only includes those CEOs who continued issuing forecasts. We therefore used a Heckman two-stage model to correct for potential estimation biases. In the first stage, we ran a probit regression model with robust standard errors, using the sample of all 319 CEOs who issued materially inaccurate first forecasts. We regressed a binary indicator of whether each of these CEOs continued issuing management forecasts on a list of variables that have been suggested in the accounting literature to affect the likelihood of managers continuing to issue forecasts (e.g., Feng and Koch, 2010), as well as industry and year dummy variables. These variables included: 1) the characteristics of prior management forecasts (a dummy variable indicating whether *actual earnings met or beat the prior forecast*, and the *market abnormal return* in a three-day window around the forecast), 2) firm characteristics (total *firm assets*, *firm beta*, *market to book* ratio, and *firm stock return volatility* (the standard deviation of daily stock returns over the previous year)), 3) the firm's informational environment (*number of analysts* following the firm, *analysts' forecast dispersion* (the standard deviation of all forecasts issued by analysts following the firm)), and 4) CEO characteristics (CEO *overconfidence* at the time when he or she issued their first

[8] Results were consistent when we used OLS regression with two-way clustering by firm and by time (cf. Cameron, Gelbach, and Miller, 2012).

management forecast, and *time lag to first management forecast* (the length of time that elapsed between an executive's entry into the CEO role and the date of their initial management forecast)). The results from this first-stage model showed that, after a materially inaccurate first forecast, high-overconfidence CEOs were significantly more likely to continue to issue management forecasts, which is consistent with our expectation that these CEOs tend to attribute their prior forecast inaccuracy to external rather than internal causes (results were consistent across each overconfidence measure). We generated an Inverse Mills Ratio (*IMR*) from the first-stage model and included it in the second-stage models to test our hypotheses.[9]

RESULTS

Table 1 reports descriptive statistics and correlations for all variables used in our analyses. Note that the inter-correlations among the three measures of overconfidence, although significant, varied in magnitude ($0.08 < r < 0.23$), which is consistent with the different underlying assumptions and empirical domains from which each measure is drawn. Tables 2, 3, and 4 report tests of our hypotheses using, respectively, *overconfidence_media*, *overconfidence_options*, and *overconfidence_success* as measures of CEO overconfidence. The dependent variable for these hypotheses was the improvement of management forecast accuracy from time *t-1* to time *t*. Model 1 in Tables 2-4 shows the baseline results with all control variables.

----- Tables 1-4 about here -----

Hypothesis 1 predicted that CEO overconfidence would be negatively associated with forecast accuracy improvement from one period to the next. Our results in Model 2 of Tables 2-4 show that the coefficients for each of the three measures were indeed negative and significant (Table 2: $\beta = -0.017$, $p<0.05$; Table 3: $\beta = -0.020$, $p<0.05$; Table 4: $\beta = -0.009$, $p<0.05$), which supports H1. In terms of economic significance, the coefficient estimate of -0.017 for

[9] Descriptive data and results for the first-stage analyses are available upon request.

overconfidence_media in Model 2 of Table 2 suggests that a one s.d. increase in overconfidence above the mean will reduce the improvement of the CEO's forecast accuracy by 0.0017 (-0.017 *0.10). Using the average improvement of forecast accuracy in our sample as the benchmark (0.0023), the magnitude of such a reduction is substantial – about 74% (0.0017/0.0023 = 74%).

Hypothesis 2 predicted that the CEO overconfidence- accuracy improvement relationship would be amplified (more negative) when the CEO's prior forecast was optimistic. Results in Model 3 of Tables 2-4 show that the interaction term between CEO overconfidence and prior optimism was negative and significant for the overconfidence_options measure (Table 3: β = -0.010, $p < .01$) and negative and marginally significant for the other two overconfidence measures (Table 2: β = -0.021, $p < .1$; Table 4: β = -0.009, $p < .1$). These results were consistent in the combined Model 6 (Table 2: β = -0.016, $p < .05$; Table 3: β = -0.013, $p < .05$ Table 3: β = -0.003, $p < .1$), supporting H2. In terms of economic significance, the coefficient estimate of -0.016 in Model 6 of Table 2 indicates that when the prior management forecast was not optimistic, there was no significant difference in the improvement of forecast accuracy between high-overconfidence and low-overconfidence CEOs. However when the prior forecast was optimistic, a high-overconfidence CEO (1 s.d. above the mean) reduced his or her improvement in forecast accuracy by 0.0021 (-0.016*0.13 = -0.0021), while a low-overconfidence CEO (1 s.d. below the mean) increased his or her improvement in forecast accuracy by 0.0011 (-0.016*-0.07 = 0.0011). Figure 1a illustrates these results using a mean forecast improvement of 0.0023 (taken from our full sample) as the baseline forecast improvement.

----- Figure 1 about here -----

Finally, Hypotheses 3 and 4 predicted that the relationship between CEO overconfidence and improvement in management forecast accuracy would be amplified (more negative) in a long

time horizon context and a high-discretion context. See Model 4 in Tables 2-4 for tests of H3 and Model 5 in Tables 2-4 for tests of H4. Consistent with H3, the interaction between overconfidence and time horizon was negative and significant for overconfidence_media (Table 2: $\beta = -0.003$, $p<0.01$) and overconfidence_options (Table 3: $\beta = -0.007$, $p<0.05$), and negative and marginally significant for overconfidence_success (Table 4: $\beta = -0.000$, $p<0.1$). These results were consistent in the combined models (Table 2: $\beta = -0.004$, $p<0.01$; Table 3: $\beta = -0.008$, $p<0.05$; Table 4: $\beta = -0.002$, $p<0.05$). Also, in line with H4, the interaction between overconfidence and managerial discretion was negative and significant for overconfidence_media (Table 2: $\beta = -0.014$, $p<0.05$), overconfidence_options (Table 3: $\beta = -0.025$, $p<0.01$), and overconfidence_success (Table 2: $\beta = -0.005$, $p<0.05$). These results were slightly weaker but generally consistent in the combined models (Table 2: $\beta = -0.007$, $p<0.1$; Table 3: $\beta = -0.038$, ns; Table 4: $\beta = -0.003$, $p<0.1$).

We followed a similar procedure as above to calculate economic significance of the coefficient estimates for testing H3 and H4. For H3, Model 6 of Table 2 indicates that an increase in CEO overconfidence of one s.d. above the mean reduced forecast accuracy improvement by 0.0018 (-0.004*4.44*0.10 = -0.0018) when the forecast horizon was short, but reduced forecast accuracy improvement by a greater magnitude of 0.0021 (-0.004*5.14*0.10 = -0.0021) when the forecast horizon was long. For H4, an increase in CEO overconfidence of one s.d. above the mean increased forecast accuracy improvement by 0.0010 (-0.007*-1.47*0.10 = 0.0010) when managerial discretion was low, but *reduced* forecast accuracy improvement by 0.0010 (-0.007*1.39*0.10 = -0.0010) when managerial discretion was high. Again, see Figures 1b and 1c for illustrations of these interactions.

Robustness tests and supplementary analyses

Overconfidence measures. We conducted several tests using alternative operationalizations of

CEO overconfidence to demonstrate the robustness of our results. First, because our theoretical arguments are based more on the 'miscalibration' component of overconfidence than the 'better-than-average' component, we re-calculated overconfidence_media after omitting all terms related to optimism. The revised measure was highly correlated with the original measure ($r = 0.92$, $p < 0.001$) and our results were unchanged. Next, to further explore whether overconfidence was more trait-like or state-like in our sample, we examined the variability of overconfidence_media for up to ten years for each CEO. Although there was a small amount of annual variation, the average values of the CEO overconfidence measure were stable over time (the standard deviation for change in overconfidence_media across years was 0.08), and t-tests revealed no significant year-on-year changes.

As an alternative to using media reports, we created a measure of overconfidence using CEO interview transcripts. We were able to find transcripts of personal interviews with 91 of the 217 CEOs in our sample. We transcribed these interviews and evaluated the transcripts using the Linguistic Inquiry and Word Count (LIWC) program (Pennebaker *et al*., 2001). The two LIWC dictionaries most relevant to our purposes were the 'certainty' words and 'tentativeness' words (see Pennebaker *et al*., 2001, for more details). For each CEO, we created a ratio of the number of words from the certainty category that appeared in the transcript divided by the number of words from the tentativeness category. This measure was significantly correlated with overconfidence_media ($r = 0.48$, $p < 0.01$).

Similar to prior research (Malmendier and Tate, 2008; Hribar and Yang, 2013), our overconfidence_media measure is based in part on automated coding of news reports. To ensure the reliability of this approach, two independent coders (unaffiliated with the study) read all media reports for a randomly selected sub-sample of 20 CEOs (these CEOs were associated with up to

twelve media reports each). Based on these reports, each coder rated the perceived overconfidence of each CEO on a scale from 1 (low) to 5 (high). There was a high level of inter-rater agreement (ICC = 0.88), and our original measure of overconfidence_media was significantly correlated with the mean overconfidence ratings from the two coders ($r = 0.53$, $p < 0.01$).

As an alternative to our overconfidence_options measure, we created a behavioral measure based on a CEO's net purchase of company stock. This measure rests on similar assumptions as our original measure. CEOs tend to be under-diversified as they generally receive large grants of stock and options as compensation and cannot hedge their risk by short-selling company stock. Risk-averse CEOs should in theory therefore seek to limit their additional investment in the equity of their firms. Following Malmendier and Tate (2005), we created a continuous measure of overconfidence operationalized as a CEO's net purchase of his or her own firm's stock in the first five years that the CEO appears in our sample. This measure was significantly correlated with overconfidence_options ($r = 0.16$, $p < 0.01$), and was associated with qualitatively similar results.

Alternative analysis of forecast accuracy improvement. Our dependent variable was the difference in management forecast accuracy (MFA) across two time periods. A potential criticism of such a measure is that it fails to demonstrate the relative contribution of each sub-component of a variable (Edwards, 1993). Therefore, we re-ran our analyses by regressing current MFA on: 1) prior MFA, 2) overconfidence_media, 3) the interaction of prior MFA and overconfidence_media, and 4) other control variables from Model 1 of Table 2. Our results showed a positive main effect of MFA_{t-1} ($\beta = 0.779$, $p<0.01$), and a negative effect of the interaction term between prior MFA and overconfidence_media ($\beta = -0.955$, $p<0.05$). These results showed that, when overconfidence increased by one standard deviation, the net effect of MFA at time t-1 on MFA at time t decreased from 0.779 to 0.684 (i.e., 0.779 - 0.955*0.10), which is consistent with our claim that high-

overconfidence CEOs pay less attention to corrective feedback than low-overconfidence CEOs.

Additional analyses. Finally, we investigated several further aspects of the forecasts issued by overconfident CEOs (using overconfidence_media). First, do overconfident CEOs issue different types of forecasts? In our sample, high-overconfidence CEOs were more likely to issue 'point' management forecasts (e.g., $1.50), rather than 'range' forecasts (e.g., between $1.45 and $1.55). The correlation between overconfidence_media and point forecasts was 0.18 ($p<0.01$). And, when overconfident CEOs did issue range forecasts, the range itself was significantly narrower than the range for low-overconfidence CEOs (the correlation between overconfidence and range width was -0.12 ($p<0.01$). However the correlation between overconfidence and forecast issue frequency was not significant ($r =0.03$, ns). Second, are analysts more likely to update their own forecasts after overconfident managers issue their management forecasts? Results indicated that, when analysts were covering high-overconfidence CEOs, they were more likely to respond to a management forecast and revise their own forecast ($r = 0.11$, $p < 0.01$). However, CEO overconfidence was not associated with the timeliness and magnitude of analyst forecast revision.

DISCUSSION

Firms often make mistakes, from largely insignificant ones such as minor product bugs, all the way up to disasters such as the recent Fukushima nuclear meltdown in Japan or the BP-Deepwater Horizon oil spill in the Gulf of Mexico. However, prior research suggests that firms' responses to errors, and thus their likelihood of repeating those errors, differ substantially. In our study, we used self-attribution theory and the construct of CEO overconfidence to build a deeper understanding of the micro-foundations of corporate responses to corrective feedback.

We began with a sample of firms whose CEOs' first career management forecasts were materially inaccurate. Thus, all firms in our sample received strong corrective feedback. Within

this group of firms, we found that firms with overconfident CEOs were much more resistant to feedback. In other words, these firms made significantly smaller improvements in forecast accuracy over time compared to firms led by less overconfident CEOs. We then examined the differential impact of CEO overconfidence on forecast accuracy improvement as a result of forecast valence. As expected, the overconfidence-accuracy improvement relationship was significantly more negative following a prior optimistic forecast. Finally, we predicted that the impact of CEO overconfidence on forecast accuracy improvement would vary according to contextual factors that should influence the likelihood of self-attribution biases (Langer, 1975). We found evidence supporting our argument that self-attribution biases were strongest, and thus the negative impact of CEO overconfidence on improvement of subsequent forecast accuracy was greatest, when: 1) feedback was more ambiguous, proxied by a long time horizon between the date of previous forecast issuance and the release of actual earnings, and 2) there was greater volatility and contextual uncertainty, proxied by a high-discretion environmental context.

Implications and future research

Our study has implications for several streams of strategic management research. First, we expect that our results will generalize beyond the context of corporate earnings announcements. Although this context is a useful one in which to test our hypotheses because of the quantifiable, discrete, and, reliable nature of the feedback, we expect that CEO overconfidence will also affect corporate responses in a range of other contexts. We predict that firms led by overconfident CEOs will pay less heed in general to external indications of error. In extreme cases, returning to the examples identified at the beginning of this section, firms with overconfident CEOs may display markedly different patterns of behavior when faced with major accidents or evidence of pervasive corporate malfeasance. These firms are likely to be slower to react to such events (and the associated

stakeholder pressures) and more likely to attribute events to bad luck or *force majeure*. In turn, such CEOs and firms may disproportionately assert the culpability of external parties (such as customers, suppliers, or regulators), as well as making claims that any unambiguous internal causes are the result of one-off 'bad apples.' Subsequently, these types of firms may be less likely to comprehensively investigate root causes of major errors, and, therefore, more likely to repeat them. In contrast, we believe that firms led by less overconfident CEOs will be less convinced that sources of error are external and idiosyncratic, more likely to respond rapidly, more likely to conduct thorough investigations, and, therefore, less likely to repeat the same mistakes.

In addition, our study complements research in the executive succession literature. There is growing evidence that many struggling public firms engage in the 'search for a corporate savior' (Khurana, 2002) when looking for a new CEO. Individuals such as these – larger-than-life, big picture, charismatic leaders with track records of success in outside firms and industries – are probably more likely to possess high levels of overconfidence. It is possible that current selection trends in executive hiring may be resulting in a preponderance of overconfident CEOs in situations where perhaps other types of individuals might be preferred.

A further question raised by our results concerns the extent to which these phenomena are influenced by intra-TMT dynamics (cf. Lubatkin *et al*., 2006), and particularly the extent to which a firm is represented by a stable CEO/CFO pair (Hennes, Leone, and Miller, 2008). We see several possible outcomes. On the one hand, the synergy and interdependent learning that a CEO/CFO pair has built up over time may be disrupted following a change of CFO, suggesting that unstable CEO/CFO pairs should be associated with a *stronger* (more negative) overconfidence-accuracy improvement relationship. On the other hand, because the break-up of a stable CEO/CFO pair is likely to be associated with a substantial reduction in tacit knowledge within the executive suite,

firms may respond by re-emphasizing formal reporting relationships and explicit information screening systems. Such a response may therefore mitigate the impact of a particular CEO's idiosyncratic characteristics, suggesting that unstable CEO/CFO pairs might instead be associated with a *weaker* (less negative) overconfidence-accuracy improvement relationship.[10]

One final issue that we have not yet considered is the positive side of CEO overconfidence. Although our paper identifies some clear negative implications of CEO overconfidence for a firm, there are potentially a number of positive outcomes in certain situations. One of the most intriguing involves those situations where one sees (in retrospect) the benefits of persevering with a product, service, strategy, or structure that was initially unsuccessful. Whereas less overconfident CEOs may be more likely to divert resources away from such endeavors, overconfident CEOs are likely to persist, or even increase their investments. In fact, arguably, many of the most successful innovations take a long time to supplant more established competitor products (Galasso and Simcoe, 2011). In these circumstances, overconfidence may help a CEO to persevere in the face of negative feedback. More generally, the benefits of overconfidence might best be viewed in terms of person-environment fit (cf. Schneider, 1987). A highly overconfident CEO may be most useful when an industry is faced with quantum, disruptive changes, or where an entrenched, formerly successful business model is being superseded. Thus, less overconfident CEOs may be more suitable in more established environments, where strategies are more exploitative than exploratory, and adaptation is beneficial. Future research could explore those situations where high levels of overconfidence are desirable, or perhaps even essential, qualities in a firm's senior executives.

[10] To examine this issue empirically, we ran a post hoc analysis using the binary variable 'CFO change,' which was coded as one if there was a change of CFO in the years between two successive management forecasts. We then created an interaction term between CEO overconfidence_media and CFO change and used this term, the component variables, and the list of controls in Model 1 in Table 2 to predict forecast accuracy improvement. Our results showed that the interaction term was positive and significant ($\beta = 0.023$, $p < 0.05$), providing suggestive evidence that CEO/CFO instability weakens the negative impact of overconfidence on accuracy improvement.

ACKNOWLEDGEMENTS

Authors are in alphabetical order and contributed equally to the manuscript. We thank Ethan Burris, Weiru Chen, MK Chin, Shih-chi Chiu, Don Hambrick, and Mike Mannor for their helpful comments on earlier drafts of this manuscript. We are also grateful to Editor Rich Bettis and two anonymous reviewers for their detailed feedback throughout the review process. This research was funded in part by the INSEAD Alumni Fund, a National University of Singapore start-up research grant, and a 3M Nontenured Faculty Grant at the University of Texas at Austin.

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Figure 1a: Prior optimism

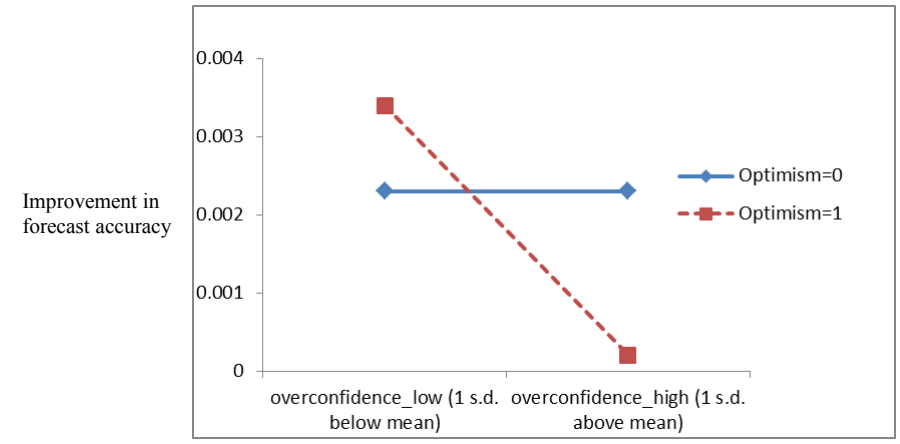

Figure 1b: Time horizon

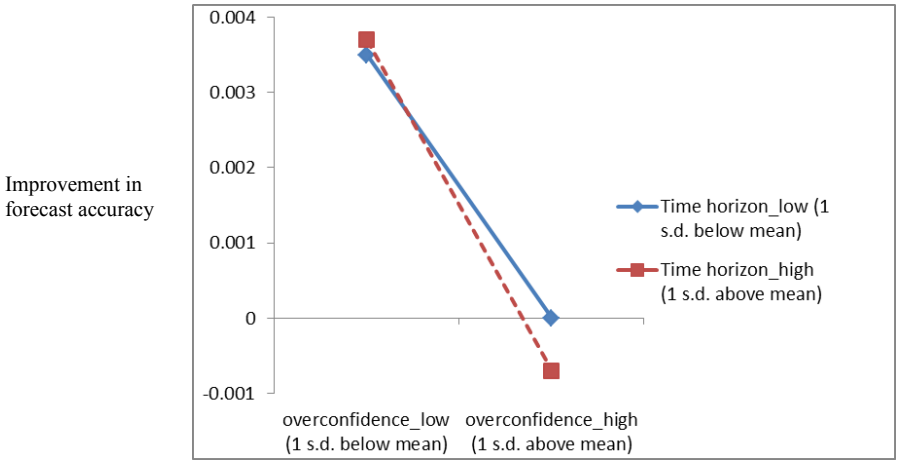

Figure 1c: Managerial discretion

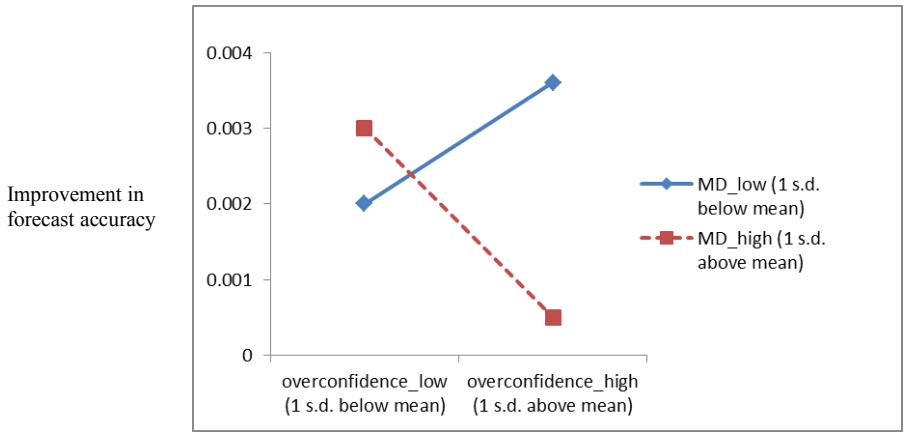

Figure 1: Moderating influences on the CEO overconfidence-forecast accuracy improvement relationship (overconfidence_media measure)

Table 1: Descriptive statistics and correlations

Variables	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1. Improvt. of MFA	0.002	0.02																							
2. Firm size	7.36	1.40	-0.06																						
3. Sales growth	0.10	0.17	-0.05	-0.20																					
4. Firm beta	1.02	0.78	0.03	-0.10	0.07																				
5. Earnings volatility	1.16	1.13	0.10	-0.07	-0.07	0.04																			
6. Bad news	0.05	0.21	-0.08	0.08	-0.03	-0.13	-0.01																		
7. IMR_media	1.63	0.48	0.01	-0.04	-0.02	-0.11	0.19	-0.09																	
8. IMR_options	1.46	0.30	0.07	-0.07	0.01	-0.06	0.14	-0.08	0.64																
9: IMR_success	1.39	0.25	0.08	-0.02	0.02	0.00	0.04	-0.05	0.42	0.65															
10. CEO duality	0.75	0.43	0.01	0.07	0.01	-0.02	-0.09	0.07	-0.10	-0.14	-0.13														
11. Outside dir. ratio	0.74	0.13	0.01	0.07	-0.09	0.02	0.01	-0.15	0.09	0.13	0.04	0.21													
12. CEO incentive str.	0.47	0.21	0.02	0.20	-0.04	0.01	0.06	0.03	0.20	0.07	0.03	0.03	0.00												
13. CEO tenure	6.29	3.15	-0.09	-0.12	0.08	-0.01	-0.04	0.09	-0.09	-0.19	-0.24	0.27	-0.06	-0.11											
14. Number of mgt. forecasts	3.80	1.95	0.02	0.21	0.01	-0.01	-0.07	0.04	0.01	0.04	0.09	0.08	0.07	0.07	0.05										
15. Number of articles	4.28	3.70	-0.04	0.84	-0.07	0.00	0.02	-0.04	0.20	0.02	0.04	0.07	-0.05	0.28	-0.10	0.19									
16. Media tenor	0.31	0.26	0.01	0.21	-0.03	-0.14	-0.02	-0.04	0.09	0.06	0.08	0.11	-0.03	0.15	-0.21	0.05	0.20								
17. Firm diversification	0.46	0.39	-0.06	0.25	-0.04	-0.02	-0.07	-0.06	0.03	0.07	0.12	-0.01	0.13	0.01	-0.11	0.18	0.15	0.07							
18. Number of analysts	11.42	5.29	-0.01	0.29	-0.01	-0.02	-0.06	0.05	0.10	-0.02	0.00	0.03	-0.11	0.26	-0.01	0.01	0.21	0.22	-0.03						
19. Time horizon	4.79	0.35	0.02	0.19	0.02	0.08	-0.03	0.05	-0.11	-0.07	-0.01	0.13	0.11	0.07	0.14	0.31	0.06	0.12	-0.04	-0.10					
20. Prior optimism	0.58	0.57	-0.04	0.04	0.02	-0.05	-0.08	-0.01	-0.04	-0.03	-0.05	0.02	-0.02	0.07	0.03	0.00	0.05	-0.02	0.16	0.01	-0.06				
21. MD index	-0.04	1.43	0.11	-0.07	0.00	0.08	0.04	-0.09	0.15	0.16	0.11	-0.02	0.04	0.06	-0.11	0.07	-0.02	0.06	0.09	0.02	0.07	-0.05			
22.CEO overconfidence _media	0.03	0.10	-0.07	0.15	-0.01	0.06	-0.01	-0.05	0.06	0.04	0.02	0.07	-0.04	0.01	0.09	0.03	0.08	0.19	-0.01	0.17	0.04	-0.04	-0.04		
23. CEO overconfidence _options	0.30	0.09	-0.05	0.36	-0.05	0.01	0.00	-0.01	0.05	0.01	0.01	0.04	-0.01	0.11	-0.02	0.07	0.41	0.19	0.09	0.07	0.00	-0.03	-0.06	0.09	
24. CEO overconfidence _ _success	-0.06	1.45	-0.08	0.07	-0.03	0.20	-0.10	-0.01	0.03	0.04	0.01	0.11	0.05	0.06	0.07	0.03	0.06	0.58	0.06	0.09	0.05	-0.28	-0.07	0.23	0.08

N = 578; |Correlations| ≥ 0.08 are significant at the 0.05 level

Table 2: CEO overconfidence_media and forecast accuracy improvement

	(1)	(2)	(3)	(4)	(5)	(6)
Firm size	-0.024	-0.025	-0.031	-0.019	-0.037	-0.019
	(0.022)	(0.023)	(0.023)	(0.021)	(0.024)	(0.024)
Sales growth	0.015	0.015	0.018	0.024*	0.001	0.025*
	(0.015)	(0.015)	(0.014)	(0.015)	(0.012)	(0.014)
Firm beta	-0.008*	-0.010**	-0.008*	-0.009*	-0.008*	-0.008*
	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Earnings volatility	0.002**	0.002***	0.002**	0.003**	0.003**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bad news	0.005	0.002	0.004	0.006	0.006	0.005
	(0.010)	(0.010)	(0.010)	(0.011)	(0.009)	(0.011)
IMR	0.018*	0.017*	0.018*	0.018	0.021*	0.018
	(0.011)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)
CEO duality	0.003	-0.000	0.003	0.004	0.002	0.004
	(0.011)	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)
Outside director ratio	-0.058	-0.051	-0.065	-0.053	-0.058	-0.060
	(0.043)	(0.038)	(0.043)	(0.040)	(0.040)	(0.042)
CEO incentive structure	-0.005	-0.007	-0.007	-0.005	-0.006	-0.006
	(0.011)	(0.011)	(0.010)	(0.010)	(0.012)	(0.010)
CEO tenure	-0.004**	-0.003*	-0.004**	-0.005**	-0.003*	-0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Number of mgt. forecasts	0.001	0.001	0.001	0.001	0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Number of articles	-0.013*	-0.013	-0.013*	-0.016**	-0.009***	-0.016**
	(0.007)	(0.008)	(0.007)	(0.008)	(0.003)	(0.007)
Media tenor	0.009	0.003	0.013	0.018*	-0.003	0.024**
	(0.012)	(0.010)	(0.011)	(0.010)	(0.013)	(0.010)
Firm diversification	-0.008	-0.010	-0.005	-0.007	-0.001	-0.005
	(0.017)	(0.015)	(0.018)	(0.018)	(0.021)	(0.018)
Number of analysts	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Prior optimism	0.003	0.002	0.003	0.003	0.003	0.003
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Time horizon	0.023**	0.021**	0.021**	0.023**	0.023**	0.022**
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
MD index	-0.001	-0.004*	0.002	0.001	0.002	0.001
	(0.003)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)
Overconfidence_media (H1)		-0.017**	-0.006	-0.012	-0.006	-0.010
		(0.008)	(0.014)	(0.012)	(0.008)	(0.011)
Overconfidence_media * Prior optimism (H2)			-0.021*			-0.016**
			(0.011)			(0.008)
Overconfidence_media * Time horizon (H3)				-0.003***		-0.004***
				(0.001)		(0.001)
Overconfidence_media * MD index (H4)					-0.014**	-0.007*
					(0.006)	(0.003)
Constant	-0.039	-0.038	-0.025	-0.036	-0.073	-0.029
	(0.051)	(0.053)	(0.051)	(0.052)	(0.053)	(0.053)
Observations	578	578	578	578	578	578
R-squared	0.44	0.46	0.46	0.46	0.45	0.47

*p<0.1; **p<0.05; ***p<0.01

Table 3: CEO overconfidence_options and forecast accuracy improvement

	(1)	(2)	(3)	(4)	(5)	(6)
Firm size	-0.024	-0.020	-0.015	-0.018	-0.012	-0.020
	(0.022)	(0.023)	(0.022)	(0.021)	(0.021)	(0.023)
Sales growth	0.015	0.017	0.017	0.017	0.018	0.016
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Firm beta	-0.008*	-0.010**	-0.010**	-0.010**	-0.009**	-0.010**
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Earnings volatility	0.002**	0.002***	0.002***	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bad news	0.005	0.003	0.002	0.002	0.002	0.002
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
IMR	0.018*	0.017*	0.017	0.018*	0.018*	0.018*
	(0.011)	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)
CEO duality	0.003	0.001	0.001	0.001	0.001	0.000
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Outside director ratio	-0.058	-0.049	-0.050	-0.051	-0.050	-0.051
	(0.043)	(0.037)	(0.038)	(0.037)	(0.038)	(0.038)
CEO incentive structure	-0.005	-0.007	-0.008	-0.007	-0.008	-0.007
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
CEO tenure	-0.004**	-0.003*	-0.003*	-0.003*	-0.003*	-0.003*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Number of mgt. forecasts	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Number of articles	-0.013*	-0.014*	-0.014*	-0.014*	-0.014*	-0.013*
	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Media tenor	0.009	-0.000	0.004	0.001	-0.003	0.012
	(0.012)	(0.012)	(0.013)	(0.011)	(0.012)	(0.013)
Firm diversification	-0.008	-0.011	-0.011	-0.010	-0.011	-0.010
	(0.017)	(0.015)	(0.015)	(0.016)	(0.016)	(0.016)
Number of analysts	-0.000	0.000	0.000	0.000	0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Prior optimism	0.003	0.002	0.003	0.002	0.002	0.003
	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Time horizon	0.023**	0.022**	0.021**	0.022**	0.022**	0.021**
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
MD index	-0.001	-0.004*	-0.004*	-0.004*	-0.004*	-0.004*
	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Overconfidence_options (H1)		-0.020**	-0.021**	0.004	-0.005	0.013
		(0.010)	(0.009)	(0.018)	(0.009)	(0.022)
Overconfidence_options * Prior optimism (H2)			-0.010***			-0.013**
			(0.003)			(0.006)
Overconfidence_options * Time horizon (H3)				-0.007**		-0.008**
				(0.003)		(0.004)
Overconfidence_options * MD index (H4)					-0.025***	-0.038
					(0.007)	(0.028)
Constant	-0.039	-0.045	-0.043	-0.047	-0.048	-0.042
	(0.051)	(0.052)	(0.053)	(0.053)	(0.053)	(0.053)
Observations	578	578	578	578	578	578
R_squared	0.44	0.46	0.48	0.47	0.47	0.49

*p<0.1; **p<0.05; ***p<0.01

Table 4: CEO overconfidence_success and forecast accuracy improvement

	(1)	(2)	(3)	(4)	(5)	(6)
Firm size	-0.024	-0.042*	-0.025	-0.043*	-0.024	-0.046*
	(0.022)	(0.023)	(0.022)	(0.022)	(0.022)	(0.023)
Sales growth	0.015	0.009	0.013	0.008	0.018	0.009
	(0.015)	(0.012)	(0.013)	(0.012)	(0.013)	(0.012)
Firm beta	-0.008*	-0.010**	-0.008**	-0.008**	-0.007	-0.007
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)
Earnings volatility	0.002**	0.002**	0.003**	0.002**	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bad news	0.005	0.005	0.008	0.006	0.006	0.006
	(0.010)	(0.009)	(0.010)	(0.010)	(0.009)	(0.009)
IMR	0.018*	0.019*	0.018*	0.019*	0.022**	0.044*
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.023)
CEO duality	0.003	-0.001	0.004	-0.001	0.003	0.005
	(0.011)	(0.008)	(0.010)	(0.008)	(0.010)	(0.009)
Outside director ratio	-0.058	-0.032	-0.033	-0.033	-0.056	-0.018
	(0.043)	(0.034)	(0.033)	(0.033)	(0.040)	(0.036)
CEO incentive structure	-0.005	-0.002	-0.005	-0.003	-0.007	-0.000
	(0.011)	(0.010)	(0.010)	(0.009)	(0.011)	(0.011)
CEO tenure	-0.004**	-0.004**	-0.004**	-0.004**	-0.004**	-0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Number of mgt. forecasts	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total number of news articles	-0.013*	-0.009	-0.012*	-0.008	-0.008	-0.007
	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)
Media tenor	0.009	0.047**	0.014	0.041**	0.005	0.021
	(0.012)	(0.018)	(0.014)	(0.017)	(0.011)	(0.031)
Firm diversification	-0.008	-0.003	-0.004	-0.003	-0.004	0.011
	(0.017)	(0.017)	(0.018)	(0.017)	(0.017)	(0.021)
Number of analysts	-0.000	0.000	-0.000	0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Prior optimism	0.003	0.001	0.000	0.001	0.003	-0.002
	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Time horizon	0.023**	0.026**	0.022**	0.027**	0.022**	0.031**
	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)	(0.013)
MD index	-0.001	0.001	0.001	0.001	0.004	0.002
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Overconfidence_success (H1)		-0.009**	0.001	-0.010***	-0.001	0.002
		(0.004)	(0.001)	(0.004)	(0.001)	(0.002)
Overconfidence_success * Prior optimism (H2)			-0.009*			-0.003*
			(0.005)			(0.002)
Overconfidence_success * Time horizon (H3)				-0.000*		-0.002**
				(0.000)		(0.001)
Overconfidence_success * MD index (H4)					-0.005**	-0.003*
					(0.002)	(0.002)
Constant	-0.039	-0.085	-0.057	-0.090	-0.059	-0.064
	(0.051)	(0.055)	(0.049)	(0.056)	(0.055)	(0.088)
Observations	578	578	578	578	578	578
R_squared	0.44	0.47	0.49	0.48	0.47	0.50

*p<0.1; **p<0.05; ***p<0.01