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### CEO Overconfidence and Management Forecasting

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## CEO Overconfidence and Management Forecasting\*

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## CEO Overconfidence and Management Forecasting

### **Abstract**

This paper examines how overconfidence affects the properties of management forecasts. Using both the ‘over-optimism’ and ‘miscalibration’ dimensions of overconfidence to generate our predictions, we examine three research questions. First, we examine whether overconfidence increases the likelihood of issuing a forecast. Second, we examine whether overconfidence increases the amount of optimism in management forecasts. Third, we examine whether overconfidence increases the precision of the forecast. Using both options- and press-based measures to proxy for individual overconfidence we find support for all three research questions.

Keywords: overconfidence, behavior biases, management forecasts, voluntary disclosure

JEL Classifications: M41

## 1. Introduction

Research has examined how different aspects of individual psychology affect asset prices in equilibrium (e.g. Kyle and Wang 1997; Daniel, Hirshleifer, and Subrahmanyam 1998; Odean 1998; Fischer and Verrecchia 1999; Gervais and Odean 2001; Libby, Bloomfield, and Nelson 2002). These papers use evidence in social psychology on individual decision-making as potential explanations for observed empirical regularities in asset prices, such as momentum or post-earnings announcement drift. In contrast, research studying the effects of individual psychology and decision biases on corporate policies and executive decision-making has been sparse until recently. Heaton (2002) discusses this discrepancy between the literatures. He notes that the lack of behavioral economics in corporate decision-making research is puzzling, because the common objections to behavioral economics have less vitality in this setting than in asset pricing. The effects of individual psychology should be easier to detect in the context of corporate decisions, where there exists little or no arbitrage mechanism, and where significant decisions, such as corporate acquisitions, are relatively infrequent with delayed and noisy feedback.<sup>1</sup> With the introduction of archival measures of overconfidence, recent studies have examined links between overconfidence and corporate decisions such as acquisitions, cash flow sensitivity, financial reporting, and risk taking behavior (Malmendier and Tate 2005, 2008; Ahmed and Duellman 2012; Hirshleifer, Low, and Teoh 2012; Schrand and Zechman 2012; Ben-David, Graham, and Harvey 2013).

Our study examines the effect of overconfidence on management forecasting behavior using actual forecast data. The setting of management forecasting in which managers control (i) the decision to forecast, (ii) the level of the forecast, and (iii) the precision of the forecast makes it particularly well-suited to study the effects of overconfidence. Prior research suggests that

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<sup>1</sup> Roll (1986) expresses similar sentiments, arguing that managerial hubris is likely to contribute to corporate takeovers, because of the substantial influence of the executives in these decisions.

individual overconfidence has two key facets: over-optimism and miscalibration (Skala 2008; Libby and Rennekamp 2012).<sup>2</sup> Over-optimism refers to individuals that are unrealistically optimistic about uncertain outcomes. This over-optimism has been linked to the ‘better than average’ effect, where individuals tend to overestimate their ability relative to average, and the ‘illusion of control’, where individuals believe they have greater control over uncertain events and do not fully account for random or uncontrollable events (Larwood and Whittaker 1977). Over-optimism is akin to an *overestimation of the mean*, where the overconfident individual believes that an uncertain outcome will be better than what would be predicted by an unbiased expectation (e.g. over-estimating the S&P500 expected return next year relative to historic averages). Miscalibration is associated with individuals underestimating uncertainty when predicting uncertain events. Miscalibration is therefore akin to an *underestimation of the variance*, leading to subjective probability distributions with respect to uncertain events that are set too narrowly (e.g. a confidence interval around the prediction of next year’s expected S&P500 return that is narrower than historic norms).

Both facets of overconfidence are likely to be important in the context of management forecasting, where managers voluntarily issue forecasts about unknown future earnings. Importantly, both can be used to generate testable hypotheses related to the different aspects of management forecasting. We test for three potential consequences of overconfidence with respect to management forecasts. First, we examine whether overconfidence increases the likelihood that CEOs issue forecasts. Second, conditional on issuing a forecast, we examine whether

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<sup>2</sup> As discussed in section 2, overconfidence derives from both a stable individual trait and from environmental factors. For example, Libby and Rennekamp (2012) show that self-serving attribution resulting from variation in task difficulty -- an environmental factor -- increases overconfidence incremental to the stable trait that they measure using standard psychometric tests. They further find that *both* manipulated self-serving attribution and stable traits related to overconfidence are positively related to forecast issuance. More generally, their finding highlights how the effect of overconfidence in a corporate decision context is a function of both the underlying individual overconfidence and the environmental factors surrounding the decision.

overconfidence is associated with a greater probability of missing forecasts, controlling for other determinants of forecast accuracy. Third, we examine whether overconfidence affects the precision of the forecast, with overconfident CEOs being more likely to issue forecasts with narrower ranges.

We measure CEO overconfidence using empirical measures that have been developed in prior research using option-exercise behavior and popular press characterizations of the CEO (e.g. Malmendier and Tate 2005, 2008; Jin and Kothari 2008; Campbell, Gallmeyer, Johnson, Rutherford, and Stanley 2011; Malmendier, Tate, and Yan 2011; Hirshleifer et al. 2012). Our primary measure of overconfidence classifies managers as overconfident if they overexpose themselves to the idiosyncratic risk of their firms. Following Campbell et al. (2011) and Hirshleifer et al. (2012), we calculate the average moneyness of the CEO's option portfolio for each year and classify CEOs as overconfident if they hold options with average moneyness of at least 67% more than once during our sample period. This sample includes large U.S. firms covered by Execucomp from 2001 to 2010. Our alternative measure of overconfidence is based on press portrayals of the CEO. Malmendier and Tate (2008) classify a CEO as overconfident if she/he is more frequently described as confident and optimistic relative to descriptors such as frugal, conservative, cautious, practical, reliable, or steady. This measure is hand-collected from press coverage of the CEO, and the sample consists of all Fortune 500 firms from 2001 through 2007. One benefit of using this additional measure is that it provides a validation of the option-based measure and is less susceptible to endogeneity concerns.

Consistent with our first hypothesis, we find that overconfidence is positively associated with the decision to issue voluntary forecasts, although this is only significant for the press-based measure and the Malmendier and Tate measure computed post-2006. Consistent with our second hypothesis, we find that overconfident managers are more likely to issue forecasts that they subsequently miss, and that their forecasts have a greater optimistic bias. This holds after

controlling for the self-selection associated with forecasting, and after controlling for year and industry fixed effects, and standard firm-level predictors of managerial forecast errors. Consistent with our third hypothesis, we find that overconfidence affects forecast precision, measured as the width of the forecast when issued as a range. As a robustness check, we also use the package-level data on CEO option holdings available in Execucomp beginning in 2006 to replicate the proprietary measure used in Malmendier and Tate (2005, 2008) and Malmendier et al. (2011) and find similar results.

Our results have important implications for managers as survey evidence suggests that they are concerned about setting disclosure precedents that cannot be maintained because of concerns with issuing unattainable forecasts (Graham, Harvey, and Rajgopal 2005). If overconfidence leads CEOs to issue forecasts at a higher rate, and these forecasts are either too optimistic or too narrowly specified, this will increase the chance of missing the forecast, which has significant consequences for their reputation, credibility and career prospects (Hutton and Stocken 2009; Mergenthaler, Rajgopal, and Srinivasan 2011). Moreover, given the asymmetric market punishment for missed earnings forecasts documented in prior studies, it is important to understand additional reasons why managers might fail to meet their own projections (Soffer, Thiagarajan, and Walther 2000).

Our paper contributes to several streams of literature. First, we add to the growing literature on the role that individual psychology plays in corporate decisions. Prior studies contend that overconfident CEOs are more acquisitive and over-invest in projects they perceive as less risky, leading to reductions in firm value in the long run (Malmendier and Tate 2005, 2008). Firms with overconfident CFOs also have a lower propensity to pay out dividends and a higher propensity to engage in market timing (Ben-David et al. 2013). Schrand and Zechman (2012) further suggest that overconfidence leads to greater financial misreporting. Hirshleifer et al. (2012), however, document a positive aspect of CEO overconfidence. Their findings suggest that

overconfident CEOs invest more in risky projects and achieve more innovative success. We add to this body of research by showing that overconfidence also affects the form and content of voluntary management forecasts.

We also contribute to the literature on management forecasts and provide evidence that overconfidence is an important determinant of firms' forecast properties. As Hirst, Koonce, and Venkataraman (2008) conclude in their review of the literature on management forecasts: "...managers' choice of forecast characteristics appears to be the least understood (both in terms of theory and research) even though it is the component over which managers have the most control." Our findings shed light on this observation and suggest that managers' individual traits play a strong role in determining both forecast specificity and forecast precision, in addition to the decision to issue forecasts.<sup>3</sup>

The paper proceeds as follows. The next section reviews prior literature and motivates our hypotheses, and Section three describes our research design. Section four presents our main results and Section five describes our additional sensitivity analyses. Section six summarizes our results and concludes the paper.

## **2. Literature review and hypotheses development**

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<sup>3</sup> It is plausible that CFOs, rather than CEOs, are heavily involved in planning and developing forecasts and that "assortative matching" between CEO and CFO preferences would provide us with similar results. However, anecdotal evidence suggests that CEOs are more likely to have the final say, as they are often the ones subject to public backlash for missing previously issued guidance. In fact, CEOs are commonly at blame when firms fail to meet their previously issued forecasts. See Jackson, E., April 29<sup>th</sup>, 2011, "What I would ask Jim Balsillie of Research in Motion this morning," *Forbes* (<http://www.forbes.com/sites/ericjackson/2011/04/29/what-i-would-ask-jim-balsillie-of-rim-this-morning/>) and Boorstin, J., October 24<sup>th</sup>, 2011, "Netflix investors don't buy CEO's long view," *CNBC* ([http://www.cnbc.com/id/45023075/Netflix\\_Investors\\_Don\\_t\\_Buy\\_CEO\\_s\\_Long\\_View](http://www.cnbc.com/id/45023075/Netflix_Investors_Don_t_Buy_CEO_s_Long_View)).



Our research draws from two streams of literature. We begin by reviewing the literature on overconfidence and how it has evolved in the corporate finance literature.<sup>4</sup> We then briefly discuss the accounting literature on voluntary earnings forecasts, followed by our specific hypotheses.

### ***Overconfidence***

As noted previously, the psychology literature shows that overconfidence manifests itself in decision making under uncertainty as both over-optimism and miscalibration. Research in finance uses both dimensions, either explicitly or implicitly, to generate predictions about the effect of individual overconfidence on economic decisions. Skala (2008) notes that these two dimensions are often comingled and simply referred to as ‘overconfidence’ in the finance literature.

One early example of research linking overconfidence to corporate decision making is Roll (1986), who claims that managerial hubris is at least as descriptive as alternative hypotheses such as taxes, synergy and inefficient target management, as an explanation for corporate takeovers. Camerer and Lovallo (1999) use an experimental setting to show that overconfidence affects the decision to enter into a business market where success depends on the individual’s skill.<sup>5</sup> Heaton (2002) develops a simple theoretical model that assumes managerial optimism and predicts that optimistic managers will have upwardly-biased cash flow forecasts, exhibit a preference for internal financing of projects because of the perceived undervaluation of the firm, and have a stronger resistance to external takeovers.

Malmendier and Tate (2005) introduce an archival measure of overconfidence that classifies managers as overconfident if they exercise options later than the optimal date, hold their

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<sup>4</sup> The notion of investor overconfidence has also been used extensively in the asset pricing literature in finance and accounting. We do not review these studies here.

<sup>5</sup> Interestingly, the degree of over-entry into a market is even stronger when individuals are allowed to self-select into the experimental group where the payoffs are skill-dependent.

options until expiration, or increase their holdings of company stock. Using these measures of overconfidence, they show that overconfident CEOs of 477 large U.S. companies between 1980 and 1994 have a heightened sensitivity of corporate investment to cash flow. They attribute this finding to the fact that overconfident CEOs are more likely to overestimate the returns of investment projects, and invest more when internal funds are sufficient. Employing the same measure, Malmendier and Tate (2008) find that overconfident CEOs are also more acquisitive and engage in more value-destroying mergers because they overestimate their ability to generate returns. Although Malmendier and Tate (2005, 2008) use proprietary data, changes to the data collected by Execucomp allows this measure to be computed for a broad sample of firms starting in 2006.

One concern with the option-based measure is the potential endogeneity in a model that links the CEO's equity holdings to his/her corporate decisions, and the possibility of omitted variables. Malmendier and Tate (2008) therefore construct a second measure of overconfidence based on outsiders' perceptions of the CEO, using popular press characterizations. They argue the press-based measure of overconfidence is less likely to suffer from the same endogeneity concerns as the equity-based measure of overconfidence. Specifically, it is more difficult to argue that the manner in which a CEO is described in the press subsequently alters his/her behavior in a manner consistent with the description (e.g. describing a CEO as aggressive causes him/her to make more aggressive decisions). A disadvantage of this measure is that it is likely to be a noisy instrument, measuring the true degree of CEO confidence with a significant amount of error. Moreover, the extent to which CEOs receive press coverage varies substantially and this measure can only be constructed in firms where there is likely to be substantial press coverage of the CEO.<sup>6</sup>

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<sup>6</sup> A third measure of overconfidence is used by Ben-David et al. (2013). They survey CFOs and measure the confidence bounds that they provide when asked to estimate the future performance of a stock index. Overconfidence is then defined as setting confidence intervals too narrowly relative to the historical variance of the stock index, thereby focusing on miscalibration. This

Hirshleifer et al. (2012) use both the option-based and press-based measures in their study of the effects of overconfidence on investments in risky projects. While both measures provide results consistent with their hypothesis that overconfident CEOs invest more in R&D, apply for more patents, and enjoy more innovative success, they argue that the press-based measure is more stringent and less likely to proxy for inside information. Although they use similar measures to Malmendier and Tate (2005, 2008), Hirshleifer et al. (2012) derive their predictions from the miscalibration facet of overconfidence, whereas Malmendier and Tate (2005, 2008) derive their predictions from the over-optimism facet.

Note that the studies discussed above are motivated from both the optimism and miscalibration dimensions of overconfidence, although most refer to the construct as ‘overconfidence’ (e.g. Malmendier and Tate 2005, 2008; Jin and Kothari 2008; Hirshleifer et al. 2012; Ben-David et al. 2013). To operationalize overconfidence, we use the first two measures discussed above, option-based and press-based, which can be computed from publicly available data. We rely on both the optimism and miscalibration effects to generate predictions about management forecasting, despite the fact that the empirical measures of overconfidence do not distinguish between these dimensions. Thus, our hypotheses assume that the empirical measures capture some of each dimension. For example, the decision of a CEO to hold in-the-money options could be related to an over-optimistic outlook for future stock returns, as well as a belief that the distribution of expected future stock price is less variable than it really is. Similarly, individuals described as overconfident in the popular press could reflect either of these dimensions. In contrast to much prior research, we distinguish whether each hypothesis stems from optimism or miscalibration.

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measure has the advantage of directly measuring the construct of interest and is more consistent with experimental studies that measure overconfidence using psychometric tests. The downside is that the measure is proprietary and only exists for a self-selected set of managers.

### *Hypothesis development*

Prior research suggests a number of incentives for why firms voluntarily issue forecasts. Skinner (1994) argues that one reason firms issue forecasts is the preemptive dissemination of bad news, thereby fending off litigation. Matsumoto (2002) and Cotter, Tuna, and Wysocki (2006) suggest that firms use guidance to guide analysts' forecasts downward to avoid a negative earnings surprise. Nagar, Nanda, and Wysocki (2003) hypothesize and find that managers with more stock-based incentives issue more frequent forecasts to avoid equity mispricing, as it could adversely affect their personal wealth. Ajinkya, Bhojraj, and Sengupta (2005) study the effect of corporate governance mechanisms on forecast properties and find that firms with greater institutional ownership and outsider directors are more likely to provide forecasts. Their forecasts are also less optimistically biased and more precise.

More generally, the literature on management forecasts has demonstrated a number of different economic incentives to issue forecasts as well as the constraints on forecast optimism. A recent study by Bamber, Jiang, and Wang (2010) follows managers across firms and finds that managers exhibit individual-specific styles in their forecasts. Our study differs from theirs in that we use an identifiable individual trait (overconfidence) to generate directional predictions about its effect on voluntary disclosure decisions.

Our first prediction relates to the likelihood of issuing a forecast. We predict that CEO overconfidence will be positively associated with the decision to issue forecasts because of both optimism and miscalibration.<sup>7</sup> Optimism increases the expectation of future performance, which increases the willingness to commit to performance by issuing a forecast (Libby and Rennekamp 2012). Additionally, the miscalibration effect suggests that overconfident individuals

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<sup>7</sup> Technically, 'dispositional optimism' is over-optimism stemming from a stable, individual trait, and is the component of over-optimism that we are interested in studying. However, optimism can also stem from environmental factors that temporarily increase one's optimism. For brevity, we use the term optimism throughout.

underestimate the variance of uncertain outcomes, increasing their confidence in the ability to predict future performance and a willingness to commit by providing a voluntary forecast. In support of these assertions, Libby and Rennekamp (2012) provide evidence that both dimensions contribute to the likelihood of forecasting using experimental and survey research methods.<sup>8</sup> In their experimental task, they separately measure optimism and miscalibration using psychometric tests. They find that both aspects of overconfidence affect subjects' willingness to commit, their proxy for forecasting. Moreover, these stable effects are incremental to the self-serving attribution that is manipulated in the experiment. Our first hypothesis is essentially an archival counterpart to the experimental and survey evidence in Libby and Rennekamp (2012), and is as follows:

HYPOTHESIS 1 (forecast issuance). *Overconfidence is positively associated with the likelihood of issuing a management earnings forecast.*

Our second hypothesis is generated primarily from the dispositional optimism aspect of overconfidence. We expect that overconfidence will be positively associated with the likelihood of issuing upwardly biased (i.e. overly-optimistic) earnings forecasts, leading overconfident CEOs to miss their voluntary earnings forecasts more frequently. This is consistent with the interpretation of overconfidence used by Malmendier and Tate (2005, 2008) and Jin and Kothari (2008), where it affects one's assessment of their acumen relative to the average. Overconfident managers are more likely to issue an overly optimistic forecast because they are generally more optimistic about the future of the firm, and also overestimate their ability to influence earnings and underestimate the probability of unexpected events, such as fluctuations in the business cycle. This leads to our second hypothesis, in alternative form:

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<sup>8</sup> In contrast to the studies mentioned above that treat overconfidence as a stable trait, Hilary and Hsu (2011) examine the effects of dynamic overconfidence from self-attribution.

HYPOTHESIS 2(optimism). *Conditional on issuing a forecast, overconfidence is positively associated with the amount of optimism embedded in management forecasts.*

Our third hypothesis is generated from the miscalibration aspect of overconfidence. If miscalibration leads managers to underestimate the variance of random events, then overconfident managers will believe they can forecast the future with greater precision. We expect this will manifest itself in the precision of their range forecasts. Specifically, we expect that overconfident managers will issue forecasts with narrower ranges, conditional on issuing a range forecast. This leads to the following hypothesis:

HYPOTHESIS 3 (precision). *Conditional on issuing a range forecast, overconfidence is negatively associated with the width of the range.*

### **3. Research design**

#### *Sample selection and variable definitions*

Our option-based sample consists of 2,179 U.S. firms, 3,305 CEOs, and 13,120 firm-years. Following recent studies (Campbell et al. 2011; Malmendier et al. 2011; Hirshleifer et al. 2012), we use year-by-year aggregate data on CEO vested option holdings available in Execucomp from 2001 to 2010. *Conf(Holder67)* is a dummy variable equal to one if the CEO holds vested options with average moneyness of 67% or more at least twice during the sample period, starting in the first year the CEO displays this behavior. Average moneyness is calculated as follows. We first estimate the realizable value per option as the total realizable value of options divided by the number of exercisable options. The average exercise price is estimated as the difference between the year-end stock price and the realizable value per option. The average moneyness of options is then calculated as the realizable value per option divided by the average exercise price. Once a

CEO is identified as overconfident using this measure, he/she remains so during the rest of the sample period.

As an alternative to the option-based measure, our second approach relies on press portrayals of the CEO. This sample consists of 607 Fortune 500 firms, 907 CEOs, and 3,298 firm-years from 2001 to 2007. We collect press coverage information on CEOs of these firms for our sample period and employ a financial press-based measure of CEO overconfidence. We search for articles referring to the CEOs in the New York Times, Business Week, Financial Times, the Economist, Forbes, Fortune, Time, and the Wall Street Journal using Factiva. We record four statistics for each CEO in our sample: the number of articles describing the CEO using the terms “confident” or “confidence” (*Confident*); the number of articles describing the CEO using the terms “optimistic” or “optimism” (*Optimistic*); the number of articles describing the CEO using the terms “reliable”, “steady”, “practical”, “conservative”, “frugal”, or “cautious” (*Cautious*); and the number of articles describing the CEO using the terms “not confident” or “not optimistic” (*Not Confident*).<sup>9</sup> *SumTotal* is the number of articles in which the CEO is mentioned during the entire sample period. We read each article to verify that the word is used in an appropriate context and relevant to the CEO of interest.

We develop our press-based variable of CEO-specific overconfidence using these article counts. *Conf(Press)* is a continuous variable that captures the frequency with which a CEO is described as confident or optimistic relative to conservative or not optimistic, and is computed as follows:

$$Conf(Press) = [(Confident + Optimistic) - (Cautious + Not Confident)] / SumTotal$$

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<sup>9</sup> In construction of the press-based measure, we closely follow Malmendier and Tate (2008) and Hirshleifer et al. (2012) and combine the number of “optimistic/optimism” and “confident/confidence” mentions in a summary measure. In untabulated analyses, we obtain qualitatively similar results when we test for the effect of optimism (miscalibration) using only the number of optimistic/optimism (confident/confidence) mentions.

*Confident*, *Optimistic*, *Cautious*, *Not Confident*, and *SumTotal* are article counts for the entire sample period and, thus are CEO-specific. The measure ranges from -1 to 1. Observations for which there are no press mentions describing the CEO as confident or conservative in a given year are assigned a value of 0 and tend to fall in the middle of the distribution. Unlike *Conf (Holder67)*, which categorizes CEOs into discrete groups of overconfident and not overconfident, we focus on the continuous *Conf (Press)* measure, primarily because we believe there is information in the relative frequency with which a CEO is referred to as confident.<sup>10</sup> Additionally, *Conf (Press)* does a better job of neutralizing the CEOs with no press coverage because they fall in the middle of the distribution instead of being grouped with the non-overconfident group.<sup>11</sup>

Table 1 provides the distribution of our overconfidence measures. In panel A, we show that the percentage of CEOs classified as overconfident ranges from 36 to 51 percent each year for *Conf (Holder67)*. The frequency of overconfident CEOs is similar to Malmendier et al. (2011), who report an average of 49% in their online Appendix for their sample period from 1992 to 2007. Panel B reports the mean of *Conf (Press)* from 2001 to 2007. Panel C reports a comparison of the two measures for the sub-sample of CEO-years with overlapping data. We split *Conf (Press)* at the median and find that 15% (38%) of the sub-sample of CEO-years are classified as (not) overconfident by both measures. Hirshleifer et al. (2012) find that both measures classify the CEO

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<sup>10</sup> For example, if CEO X had 10 overconfident mentions and zero conservative mentions, and CEO Y had 4 overconfident mentions and 3 conservative mentions, a binary overconfidence measure would assign both CEOs a value of 1, whereas *CONF* would assign CEO X a value of 1, and CEO Y a value of 0.14.

<sup>11</sup> To address the possible concern that CEOs with no press coverage are fundamentally different, we also conduct our analyses using a sample that eliminates all CEOs with zero press coverage in year *t*. Although this reduces the number of observations, it alleviates the concern that the press is likely to feature a CEO when there is something to discuss, leading to an overrepresentation of CEOs with no press coverage in the non-overconfident group. The untabulated results suggest that our inferences remain unchanged when we restrict our sample to firm-years with no press coverage.



as overconfident for 6% of their subsample of CEO-years with overlapping data.<sup>12</sup> The (untabulated) pair-wise correlation between *Conf (Press)* and *Conf (Holder67)* is 0.04 ( $p < 0.05$ ) for this sub-sample, compared to 0.05 ( $p < 0.01$ ) reported in Malmendier and Tate (2008) panel B of Table 8.

**[TABLE 1]**

To provide evidence on management forecasting behavior, we combine the CEO data with a sample of quantitative annual management EPS forecasts reported in the *Company Issued Guidelines File (CIG)* maintained by *First Call*.<sup>13</sup> We obtain actual earnings from the *First Call Actuals File* to ensure consistency between management forecasts and EPS realizations. We exclude qualitative forecasts from our sample because we have no objective criterion for determining whether such forecasts were missed. Table 2 reports descriptive statistics on management forecasts for the two samples. For the option-based sample, there are 28,211 management forecasts during the 2001 to 2010 sample period. The frequency of point, range, and open-ended forecasts are 11.5%, 85.59%, and 2.91%, respectively. For the press-based sample, there are 7,822 management forecasts during the 2001 to 2007 sample period. The forecasts are evenly distributed with a slightly lower level in the first year. The frequency of point, range, and open-ended forecasts are 13.56%, 81.96%, and 4.47%, respectively. The lower frequency of point forecasts in the option-based sample is likely due to firms providing less specific forecasts in 2008-2010.

**[TABLE 2]**

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<sup>12</sup> Hirshleifer et al. (2012) also report that 3% of the CEO-years are classified as overconfident by the press-based measure while the option-based measure indicates otherwise. They do not report the percentage of CEO-years classified as not overconfident using both measures, or the percentage of CEO-years classified as overconfident by the option-based measure, but not the press-based measure.

<sup>13</sup> We restrict our analyses to annual forecasts because optimism is more likely to manifest itself when earnings are most uncertain. Therefore, we expect the effect of overconfidence to have a limited effect in the context of quarterly forecasting, where managers are likely to receive more frequent and timely feedback.

To examine the effect of overconfidence on management forecasts, we define the forecast properties as follow. *Issue* is a dummy variable equal to one if the firm issued at least one forecast in year  $t$ , and zero otherwise. *Miss* is an indicator variable that is set to 1 if a manager misses their own earnings forecast for the fiscal year, and zero otherwise. For open-ended and point estimates, the forecast is coded as *Miss*=1 if the actual EPS is less than the estimated EPS, and zero otherwise. For range estimates, the forecast is coded as *Miss*=1 if the actual EPS is less than the lower bound of the range forecast.<sup>14</sup> We also examine whether forecast optimism increases with overconfidence. We construct a continuous variable, *OptBias*, defined as the management forecast minus actual earnings, scaled by logged assets per share. To test the third hypothesis on forecast precision, we use only range forecasts and define *Range* as the difference between the upper and lower bound of the range forecast, scaled by logged assets per share. We include several control variables in our analyses, which we describe in the relevant sections. We collect data on firm characteristics from Compustat, data on analyst following from IBES, and data on institutional holdings from Thomson Financial. A detailed summary of the variable definitions is provided in the Appendix.

Table 3 reports summary statistics for the two alternative samples. The likelihood of forecast issuance is 0.49 for the option-based sample and 0.59 for the press-based sample, while the likelihood of a missed forecast is similar between the two. The optimistic bias in the forecasts is also similar, while firms in the press-based sample issue forecasts with a wider range. In terms of firm characteristics, firms in the press-based sample appear to be larger, as measured by the number of analysts following and total assets.

### [TABLE 3]

## 4. Empirical results

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<sup>14</sup> In untabulated analyses, we also use the mid-point for range forecasts and find similar results.

*Is overconfidence associated with issuing voluntary forecasts?*

Our first hypothesis relates to whether overconfident CEOs are more likely to issue forecasts. This question is important for two reasons. First, we are interested in learning whether overconfidence increases the likelihood that a manager will decide to issue a forecast in the first place. Second, our later tests examining optimism and forecast form use only the firms that issue forecasts. We therefore have a censored dependent variable, in that we observe forecast errors only for CEOs who make the decision to forecast. Because the set of firms that provide voluntary forecasts of earnings are a self-selected sample that might be affected by overconfidence, we need to control for the possible self-selection bias where we only examine CEOs that forecast (e.g. Heckman 1979).<sup>15</sup> We therefore use the forecast prediction model as the first stage in a two-stage Heckman procedure to try to remove any potential bias.

We model the forecast decision as a function of several factors that have been associated with the voluntary disclosure decision. The logit models predicting the likelihood of a forecast are:

$$\begin{aligned} \text{Pr}(\text{Issue}) = & \alpha_0 + \alpha_1 \text{Conf} + \alpha_2 \text{LnAnalysts} + \alpha_3 \text{Inst} + \alpha_4 \text{Size} + \alpha_5 \text{EarnVol} + \alpha_6 \text{LitRisk} \\ & + \alpha_7 \text{ChgEarn} + \alpha_8 \text{MTB} + \alpha_9 \text{EquityIssue} + \alpha_{10} \text{M \& A} + \alpha_{11} \text{Weak} + \alpha_{12} \text{Roa} \\ & + \alpha_{13} \text{Loss} + \alpha_{14} \text{ShrOwn} + \alpha_{15} \text{Vested} + \text{Industry \& Year Effects} + \varepsilon \end{aligned} \quad (1a)$$

$$\begin{aligned} \text{Pr}(\text{Issue}) = & \alpha_0 + \alpha_1 \text{Conf} + \alpha_2 \text{LnAnalysts} + \alpha_3 \text{Inst} + \alpha_4 \text{Size} + \alpha_5 \text{EarnVol} + \alpha_6 \text{LitRisk} \\ & + \alpha_7 \text{ChgEarn} + \alpha_8 \text{MTB} + \alpha_9 \text{EquityIssue} + \alpha_{10} \text{M \& A} + \alpha_{11} \text{Weak} + \alpha_{12} \text{Roa} \\ & + \alpha_{13} \text{Loss} + \alpha_{14} \text{SumTotal} + \text{Industry \& Year Effects} + \varepsilon \end{aligned} \quad (1b)$$

The coefficients on overconfidence (*Conf*) are used to test our first hypothesis that overconfident CEOs are more likely to voluntarily forecast.

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<sup>15</sup> To the extent that the determinants of the forecast decision are potential determinants of the forecast error, ordinary least squares estimates of the parameters in the forecast error equation will be biased (Maddala 1983, 222).

To control for endogeneity we need to identify a variable that predicts forecast issuance, but is not a determinant of forecast optimism and forecast precision (Larcker and Rusticus, 2008). Following Feng, Li, and McVay (2009), we use the natural log of the number of analysts following the firm (*LnAnalysts*) as the variable that is included in the forecast issuance model, but not included in the second stage models for forecast optimism and forecast precision. Prior research has shown that analyst following influences disclosure and the decision to forecast (e.g. Lang and Lundholm 1996; Feng et al. 2009), but is not associated with forecast accuracy (Ajinkya et al. 2005; Feng et al. 2009). We include firm size (*Size*), because prior research finds a positive association between disclosure and size (Lang and Lundholm 1996; Bhojraj, Libby, and Yang 2010). We control for the level of institutional ownership (*Inst*), as prior research suggests that firms with greater institutional ownership are more likely to provide management forecasts and that their forecasts are also more accurate and precise (Ajinkya et al. 2005). We include earnings volatility (*EarnVol*), as Waymire (1985) finds that firms with more volatile earnings are less likely to provide forecasts due to higher inherent uncertainty. We include a control for litigation risk (*LitRisk*) using the coefficient estimates obtained in Rogers and Stocken (2005).<sup>16</sup> Litigation fears are likely to reduce firms' incentives to provide forecasts that are made in good faith.<sup>17</sup> Finally, *Weakness* is an indicator variable that equals one if the firm disclosed a material weakness during our sample period. Feng et al. (2009) find that firms with material internal control weaknesses are

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<sup>16</sup> The argument that firms issue preannouncements to preempt litigation is less likely to apply in our setting because 1) earnings preannouncements are not included in our sample and 2) such disclosures are likely to be quarterly forecasts (Skinner 1994).

<sup>17</sup> Following Rogers and Stocken (2005), *LITRISK* is estimated from the standard normal cumulative distributive function:  $G(-5.738 + 0.141*Size + 0.284*Turnover + 0.012*Beta - 0.237*Returns - 1.340*RetVol + 0.011*Skewness - 3.161*Min_Returns + 0.378*Computer Hardware + 0.075* Electronics - 0.034*Retailing + 0.211*Computer Software)$ . Turnover is share turnover. Beta is market beta. Returns is market returns. RetVol is return volatility. Min\_Returns is the minimum of daily returns. Skewness is the skewness of daily returns. Computer Hardware, Electronics, Retailing, and Computer Software are high litigation risk industry indicators. All variables are calculated over the calendar year.

more likely to provide forecasts with greater error. Following Feng et al. (2009), we do not have a directional prediction on *Weakness* in our forecast occurrence prediction model.

We control for return on assets (*RoA*) because firms with poor performance are less likely to provide disclosures (Miller 2002). Market-to-book (*MTB*) is used to proxy for growth and proprietary costs (Bamber and Cheon 1998). Change in earnings (*ChgEarn*) is defined as change in earnings in year *t*, scaled by year-end price. We control for merger-related activities (*M&A*) and equity offerings (*EquityIssue*) to the extent that firms may supply more biased information in an attempt to reduce information asymmetry when undergoing significant events or accessing capital markets. *M&A* is an indicator variable coded equal to one if the firm's annual acquisition or merger-related costs exceeded 5% of net income (loss) in year *t*. *EquityIssue* is an indicator variable equal to one if the firm issued additional shares in year *t*. (1a) uses the option-based measures, so we also control for shares owned (*ShrOwn*) and number of vested options (*Vested*) following Malmendier and Tate (2005). *ShrOwn* is the percentage of shares outstanding owned by the CEO and *Vested* is the CEO's total number of vested options over shares outstanding, multiplied by 10. (1b) uses the press-based measure, so we control for the total number of press mentions (*SumTotal*) because it has been used as a proxy for CEO reputation (Francis, Huang, Rajgopal, and Zang 2008).<sup>18</sup>

The results of estimating the forecast prediction model are presented in Table 4. The first column presents results using *Conf (Holder67)*, and we fail to find support that overconfident CEOs, as measured by their option-exercising behavior, are more likely to issue forecasts. However, the coefficient on *Conf (Press)* is positive and significant in the second column. A coefficient of 2.728 suggests that the likelihood of forecast issuance is 0.455 higher for a one-standard-deviation increase in *Conf (Press)*. Consistent with our expectations, the coefficient on

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<sup>18</sup> Following Hirshleifer et al. (2012), we control for industry and year fixed effects in all of our specifications. We report p-values based on one-tailed tests for coefficients on the overconfidence measures.

*LnAnalysts* is positive and significant, which suggests that firms with more analysts following are more likely to provide forecasts. Following Feng et al. (2009), we use this variable as an instrument in the second-stage forecast outcome models to control for endogeneity. Previous studies suggest that analyst following is a determinant of forecast issuance, but not forecast properties, which makes it an ideal candidate as a valid instrument. Taken together, the results in Table 4 provide some support for the notion that overconfidence increases the likelihood of issuing a forecast, consistent with Libby and Rennekamp (2012).

**[TABLE 4]**

Because of the significance on overconfidence in the forecast prediction model, we construct the Inverse Mills ratio from the prediction models in Table 4 to control for the self-selection problem in the remaining regressions (Heckman 1979). The Inverse Mills ratio is the ratio of the standard normal probability density function to the standard normal cumulative density function. We include the Inverse Mills ratio (denoted *InvMills*) in any specification where the sample includes only firms that issue a forecast.

***Is overconfidence associated with issuing optimistic forecasts?***

We test our second hypothesis by estimating the likelihood of missing a forecast as a function of CEO overconfidence and other variables that are expected to affect management forecast accuracy or bias. Specifically, our logit models are as follows:

$$\begin{aligned} \Pr(\text{Miss}) = & \alpha_0 + \alpha_1 \text{Conf} + \alpha_2 \text{Inst} + \alpha_3 \text{Size} + \alpha_4 \text{EarnVol} + \alpha_5 \text{LitRisk} + \alpha_6 \text{ChgEarn} \\ & + \alpha_7 \text{MTB} + \alpha_8 \text{EquityIssue} + \alpha_9 \text{M \& A} + \alpha_{10} \text{Weak} + \alpha_{11} \text{Roa} + \alpha_{12} \text{Loss} + \alpha_{13} \text{ShrOwn} \\ & + \alpha_{14} \text{Vested} + \alpha_{15} \text{Horizon} + \alpha_{16} \text{News} + \alpha_{17} \text{Dacc} + \alpha_{18} \text{Conc} + \alpha_{19} \text{InvMills} \\ & + \text{Industry \& Year Effects} + \varepsilon \end{aligned}$$

(2a)

$$\begin{aligned}
\text{Pr}(\text{Miss}) = & \alpha_0 + \alpha_1 \text{Conf} + \alpha_2 \text{Inst} + \alpha_3 \text{Size} + \alpha_4 \text{EarnVol} + \alpha_5 \text{LitRisk} + \alpha_6 \text{ChgEarn} + \alpha_7 \text{MTB} \\
& + \alpha_8 \text{EquityIssue} + \alpha_9 \text{M \& A} + \alpha_{10} \text{Weak} + \alpha_{11} \text{Roa} + \alpha_{12} \text{Loss} + \alpha_{13} \text{SumTotal} \alpha_{14} \text{Horizon} \\
& + \alpha_{15} \text{News} + \alpha_{16} \text{Dacc} + \alpha_{17} \text{Conc} + \alpha_{18} \text{InvMills} + \text{Industry \& Year Effects} + \varepsilon
\end{aligned}
\tag{2b}$$

*Miss* is an indicator variable equal to 1 if a firm fails to meet or exceed its earnings forecast, and zero otherwise. As before, we control for *ShrOwn* and *VestedOptions* for *Conf* (*Holder67*) and *SumTotal* for *Conf* (*Press*). Excluding the number of analysts, we include the same control variables used in the first stage model to capture the likelihood of issuing a forecast. However, the predicted sign changes on several variables. For example, although institutional ownership increases the likelihood of forecasting, it decreases the likelihood of missing the forecast because institutional ownership is associated with greater forecast accuracy. For brevity, we do not explain the prediction on every control variable in the second stage regressions, but note the predicted sign in the respective table based on results in prior literature (e.g. Bamber and Cheon 1998; Ajinkya et al. 2005; Feng et al. 2009; Bhojraj et al. 2010). Additional control variables in the second stage regressions include a firm's discretionary accruals (*Dacc*) estimated from the modified Jones model, since Kasznik (1999) finds that firms are likely to manage earnings to avoid missing their own forecast. We also control for forecast horizon (*Horizon*) and news (*News*) because we expect managers to have less information about realized earnings the earlier the forecast is issued and if the news is bad. We also control for industry concentration (*Conc*), as firms in high-concentration industries may issue more pessimistic forecasts when investors have difficulty identifying the bias in forecasts (Rogers and Stocken 2005).

#### [TABLE 5]

Table 5 reports the results of estimating (2a) and (2b). Consistent with our second hypothesis, we find evidence that overconfident CEOs are more likely to miss their own forecasts using both overconfidence proxies. A coefficient of 0.841 on *Conf* (*Press*) suggests that a one-standard deviation increase in *Conf* (*Press*) increases the likelihood of missed forecasts by 0.192.

The coefficients on the control variables are also consistent with prior research. We find that better-performing firms, as measured by *Roa*, are less likely to miss their own forecasts while firms with losses are more likely to miss their own forecasts. Forecasts issued earlier in the fiscal period and good news forecasts are also more likely to be optimistic.

In Table 6, we provide another test of hypothesis 2 using a continuous measure of forecast optimism as the dependent variable, using the following specification:

$$\begin{aligned}
 OptBias = & \alpha_0 + \alpha_1 Conf + \alpha_2 Inst + \alpha_3 Size + \alpha_4 EarnVol + \alpha_5 LitRisk + \alpha_6 ChgEarn + \alpha_7 MTB \\
 & + \alpha_8 EquityIssue + \alpha_9 M \& A + \alpha_{10} Weak + \alpha_{11} Roa + \alpha_{12} Loss + \alpha_{13} ShrOwn + \alpha_{14} Vested \\
 & + \alpha_{15} Horizon + \alpha_{16} News + \alpha_{17} Dacc + \alpha_{18} Conc + \alpha_{19} InvMills + Industry \& Year Effects + \varepsilon
 \end{aligned}
 \tag{3a}$$

$$\begin{aligned}
 OptBias = & \alpha_0 + \alpha_1 Conf + \alpha_2 Inst + \alpha_3 Size + \alpha_4 EarnVol + \alpha_5 LitRisk + \alpha_6 ChgEarn + \alpha_7 MTB \\
 & + \alpha_8 EquityIssue + \alpha_9 M \& A + \alpha_{10} Weak + \alpha_{11} Roa + \alpha_{12} Loss + \alpha_{13} SumTotal + \alpha_{14} Horizon \\
 & + \alpha_{15} News + \alpha_{16} Dacc + \alpha_{17} Conc + \alpha_{18} InvMills + Industry \& Year Effects + \varepsilon
 \end{aligned}
 \tag{3b}$$

*OptBias* is defined as the management forecast minus actual earnings, scaled by logged assets per share. Therefore, a positive (negative) value indicates management optimism (pessimism). Consistent with results in Table 5, Table 6 shows that overconfidence increases forecast optimism. The coefficient on *Conf (Holder67)* implies that an overconfident CEO increases forecast optimism by 0.005. On the other hand, the coefficient of 4.177 for *Conf (Press)* is associated with a 0.375 increase in forecast optimism for each one-standard deviation increase in *Conf (Press)*. Consistent with the prior literature, we also find that forecast optimism is decreasing in earnings volatility and industry concentration. One control variable that runs counter to the predicted sign is the litigation risk indicator (*LitRisk*). Although we expected higher litigation risk firms to decrease the optimistic bias in forecasts, our results suggest the opposite. Overall, however, our results are consistent with our second hypothesis.

**[TABLE 6]**



### ***Overconfidence and forecast precision***

Our third hypothesis relates overconfidence to the precision of the management earnings forecast. Ben-David et al. (2012) define overconfidence as an overestimation of judgmental precision or underestimation of the variance of random processes. This suggests that overconfident managers will issue forecasts with a narrower range. We estimate the following models to test this hypothesis:

$$\begin{aligned}
 \text{Range} = & \alpha_0 + \alpha_1 \text{Conf} + \alpha_2 \text{Inst} + \alpha_3 \text{Size} + \alpha_4 \text{EarnVol} + \alpha_5 \text{LitRisk} + \alpha_6 \text{ChgEarn} + \alpha_7 \text{MTB} \\
 & + \alpha_8 \text{EquityIssue} + \alpha_9 \text{M \& A} + \alpha_{10} \text{Weak} + \alpha_{11} \text{Roa} + \alpha_{12} \text{Loss} + \alpha_{13} \text{ShrOwn} + \alpha_{14} \text{Vested} \\
 & + \alpha_{15} \text{Horizon} + \alpha_{16} \text{News} + \alpha_{17} \text{Dacc} + \alpha_{18} \text{Conc} + \alpha_{19} \text{InvMills} + \text{Industry \& Year Effects} + \varepsilon
 \end{aligned}
 \tag{4a}$$

$$\begin{aligned}
 \text{Range} = & \alpha_0 + \alpha_1 \text{Conf} + \alpha_2 \text{Inst} + \alpha_3 \text{Size} + \alpha_4 \text{EarnVol} + \alpha_5 \text{LitRisk} + \alpha_6 \text{ChgEarn} + \alpha_7 \text{MTB} \\
 & + \alpha_8 \text{EquityIssue} + \alpha_9 \text{M \& A} + \alpha_{10} \text{Weak} + \alpha_{11} \text{Roa} + \alpha_{12} \text{Loss} + \alpha_{13} \text{SumTotal} + \alpha_{14} \text{Horizon} \\
 & + \alpha_{15} \text{News} + \alpha_{16} \text{Dacc} + \alpha_{17} \text{Conc} + \alpha_{18} \text{InvMills} + \text{Industry \& Year Effects} + \varepsilon
 \end{aligned}
 \tag{4b}$$

The dependent variable *Range* is the width of range forecasts, scaled by logged assets per share.<sup>19</sup> The results are presented in Table 7. Consistent with our third hypothesis on forecast precision, we find a negative and significant coefficient on overconfidence for both measures. The coefficient on *Conf (Holder67)* implies that an overconfident CEO issues forecasts with a range of -0.403 narrower than a non-overconfident CEO. As a comparison, a firm with high litigation risk or material weaknesses is likely to issue forecasts wider by 0.969 or 1.355, respectively. The coefficients on *Conf (Press)* also suggest that overconfident CEOs issue range forecasts with

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<sup>19</sup> We also consider the absolute value of the mid-point as an alternative scale factor and find similar results. We opt not to use share price as the main scale factor because *Conf (Press)* is highly correlated with market value and would introduce a mechanical and negative relation between *Conf (Press)* and *Range* and *Conf (Press)* and *OptBias*.

narrower widths. Overall, these results are consistent with our third hypothesis on overconfidence and forecast precision.

[TABLE 7]

**5. Robustness tests and alternative hypotheses**

*Alternative measure of overconfidence*

While the evidence thus far using year-to-year aggregate Execucomp data is consistent with our hypotheses, we also examine whether our results are robust to using a less noisy proxy for overconfidence that replicates the proprietary measures developed by Malmendier and Tate (2005, 2008). Using detailed package-level CEO portfolio data on Execucomp available beginning in 2006, we classify CEOs as overconfident if they hold options with five years remaining duration, despite a 67% increase in stock price (or more). Once a CEO is identified as overconfident using this measure, they remain so during the rest of the sample period. Approximately 35% of managers are considered overconfident using this measure, compared with 46% for our main measure. The results using *Conf (Holder67\_MT)* are presented in Table 8. Column 1 reports results for the test of forecast issuance and, consistent with H1, we find that CEOs classified as overconfident using this measure are more likely to issue forecasts. The results for H2 using this measure are weaker, where we only find an effect for the likelihood of a missed forecast. Consistent with H3, overconfident CEOs are also more likely to provide forecasts with a narrower range. Overall, these results suggest that our findings are robust to using a measure that is more likely to capture CEO beliefs and less influenced by other systematic factors, as argued in Malmendier et al. (2011).

[TABLE 8]

*Signaling private information*

A concern with the option-based overconfidence proxies is that they are endogenous and possibly related to the CEO's private information about the firm's prospects. In the context of voluntary disclosure, the private information argument would suggest that overconfident managers are more likely to use forecasts to communicate their private information to outsiders. Moreover, they should also be more likely to issue good news forecasts. However, in untabulated analyses, we do not find any evidence that CEOs that hold their options too long are more likely to provide forecasts that contain good news. On the other hand, it could also mean that the CEO knows she has high ability and is trying to signal her type. However, this is inconsistent with our finding that such CEOs also issue forecasts that are more biased. Finally, private information should be time-varying, whereas as CEO option-exercising behavior is fairly persistent over time (Malmendier and Tate 2005, 2008; Hirshleifer et al. 2012).

## **6. Conclusion**

Contrary to prior studies that focus on personal or economic incentives, we relax the assumption of management rationality to examine the effect of executive overconfidence on management earnings forecasts. We provide evidence consistent with the notion that managerial overconfidence manifests itself as excessive optimism about future earnings, leading overconfident CEOs to voluntary forecast. This has two implications. First, we find that overconfident CEOs are more likely to issue and subsequently miss their own forecasts, controlling for other predictors of forecast issuance and ex-post forecast accuracy such as forecast horizon, discretionary accruals, merger and acquisition activity, and firm performance. Second, we show that overconfidence is associated with forecast precision, with overconfident CEOs issuing narrower range forecasts.

Our study therefore contributes to our understanding of why managers miss their own forecasts when the costs of failing to meet their own earnings expectations are so high. Given that Malmendier and Tate (2008) find that the market discounts mergers undertaken by overconfident

CEOs, future research in this topic could also investigate whether investors or analysts take managerial overconfidence into consideration when determining a firm's stock price based on its forecasts.

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**Appendix**


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***Overconfidence measures***

*Conf (Holder67)*      *Conf (Holder67)* is a dummy variable equal to one if the CEO holds options despite a 67% increase in stock price (or more) at least twice, beginning in the first year the CEO exhibits this behavior.

*Conf (Press)*      *Conf (Press)* is a fixed measure of CEO confidence defined as the number of articles describing the CEO as optimistic or confident minus the number of articles describing the CEO as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident, scaled by the number of CEO press mentions.

***Forecast outcome variables***

*Issue*      *Issue* equals one if the firm issued at least one forecast in year *t*, and zero otherwise.

*Miss*      *Miss* equals one if actual earnings is less than the management forecast, and zero otherwise. For range forecasts, *Miss*=1 if actual earnings is less than the lower bound of the range estimate.

*OptBias*      *Bias* is defined as the management forecast minus earnings, scaled by logged assets per share.

*Range*      *Range* is forecast range, scaled by logged assets per share.

***Control variables***

*LnAnalysts*      *LnAnalysts* is the natural log of the number of analysts following in year *t*.

*Inst*      *Inst* is percentage of institutional holdings in year *t*.

*Size*      *Size* is the natural log of the firm's assets in year *t*.

*EarnVol*      Earnings volatility is the standard deviation of income before extraordinary items scaled by assets over five years ending in year *t*.

*LitRisk*      *LitRisk* is the probability of litigation estimated using the probit model in Rogers and Stocken (2005).

*ChgEarn*      *ChgEarn* is the change in earnings in year *t*, scaled by year-end price.

*MTB*      *MTB* is market-to-book in year *t*.

*EquityIssue*      *EquityIssue* is a dummy variable equal to one if the firm issued shares in year *t*.

*M&A*      *M&A* equals one if the firm's annual acquisition or merger-related costs exceeded 5% of net income (loss) in year *t*, and zero otherwise.

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<i>Weak</i>	<i>Weak</i> equals one if the firm reported a material weakness during the sample period, and zero otherwise.
<i>Roa</i>	<i>Roa</i> is return on assets in year t.
<i>Loss</i>	<i>Loss</i> equals one if the firm reported loss in year t, and zero otherwise.
<i>ShrOwn</i>	<i>ShrOwn</i> is the percentage of shares outstanding owned by the CEO in year t.
<i>Vested</i>	<i>Vested</i> is the CEO's holdings of unexercised exercisable options over total shares outstanding in year t, multiplied by 10.
<i>SumTotal</i>	<i>SumTotal</i> is the sum of CEO press mentions over the entire sample period.
<i>Horizon</i>	<i>Horizon</i> is the number of days between forecast issuance and fiscal year end.
<i>News</i>	<i>News</i> is the management forecast minus prevailing analysts' consensus, scaled by logged assets per share.
<i>Dacc</i>	<i>Dacc</i> is discretionary accruals in year t estimated from the modified Jones model.
<i>Conc</i>	<i>Conc</i> is the industry concentration ratio and measured as the sum of revenue for the top five firms in its two-digit SIC code, scaled by sum of all firms in its two-digit SIC code.
<i>InvMills</i>	<i>InvMills</i> is the Inverse Mill's ratio estimated from the first stage of the Heckman model.

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TABLE 1

Frequency of overconfident CEOs

**Panel A:** Option-based measure sample

*Conf (Holder67)*

Year	CEOs (#)	Overconfident CEOs (#)	Overconfident CEOs (%)
2001	1,052	378	35.93%
2002	1,100	425	38.64%
2003	1,197	502	41.94%
2004	1,248	598	47.92%
2005	1,268	645	50.87%
2006	1,312	665	50.69%
2007	1,400	692	49.43%
2008	1,499	673	44.90%
2009	1,514	647	42.73%
2010	<u>1,530</u>	655	42.81%
	13,120		

**Panel B:** Press-based measure sample

*Conf (Press)*

Year	CEOs (#)	Overconfidence Mean	Overconfidence Std Dev
2001	468	0.019	0.086
2002	465	0.020	0.093
2003	471	0.018	0.074
2004	474	0.013	0.070
2005	475	0.015	0.074
2006	476	0.013	0.088
2007	<u>469</u>	0.012	0.080
	3,298		

**Panel C:** Comparison of *Conf (Holder67)* and *Conf (Press)*

	<i>Conf (Holder67)=0</i>	<i>Conf (Holder67)=1</i>	
<i>Conf (Press)≤0</i>	896 (38%)	569 (24%)	1,465 (62%)
<i>Conf (Press)&gt;0</i>	<u>552 (23%)</u>	<u>349 (15%)</u>	<u>901 (38%)</u>

1,448 (61%)	918 (39%)	2,366 (100%)
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This table provides the distribution of the overconfidence measures by year. Panel A presents the distribution of the number of CEOs, the number of overconfident CEOs, and the percentage of overconfident CEOs for the option-based measure. Panel B presents the number of CEOs and the mean and standard deviation of the press-based measure. Panel C presents a comparison of the overconfidence measures for a sub-sample of CEO-years with data available for both measures. *Conf (Holder67)* is a dummy variable equal to one if the CEO holds options despite a 67% increase in stock price (or more) at least twice. *Conf (Press)* is defined as the number of articles describing the CEO as optimistic or confident minus the number of articles describing the CEO as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident, scaled by the number of CEO press mentions over the entire sample period.

TABLE 2

## Descriptive statistics for sample of management forecasts

**Panel A:** Option-based measure sample

Year	Forecasts (#)	Forecasts (%)	Type	Forecasts (#)	Forecasts (%)
2001	1,605	5.69%	Point	3,245	11.50%
2002	2,184	7.74%	Range	24,145	85.59%
2003	2,483	8.80%	Open-ended	<u>821</u>	2.91%
2004	2,909	10.31%		28,211	
2005	2,896	10.27%			
2006	3,238	11.48%			
2007	3,341	11.84%			
2008	3,604	12.78%			
2009	2,885	10.23%			
2010	<u>3,066</u>	10.87%			
	28,211				

**Panel B:** Press-based measure sample

Year	Forecasts (#)	Forecasts (%)	Type	Forecasts (#)	Forecasts (%)
2001	713	9.12%	Point	1,061	13.56%
2002	1,004	12.84%	Range	6,411	81.96%
2003	1,120	14.32%	Open-ended	<u>350</u>	4.47%
2004	1,251	15.99%		7,822	
2005	1,216	15.55%			
2006	1,299	16.61%			
2007	<u>1,219</u>	15.58%			
	7,822				

This table provides the distribution of management forecasts by year. Panel A presents the

frequency of and the type of forecasts by year for the sample using the option-based measure.

Panel B presents the frequency of and the type of forecasts by year for the sample using the press-

based measure. Forecast type is the type of forecast issued including point, range, and open-ended

forecasts.

TABLE 3

## Summary statistics

	Option-based measure sample				Press-based measure sample		
	Mean	Median	Std Dev		Mean	Median	Std Dev
<i>Conf (Holder67)</i>	0.46	0.00	0.50	<i>Conf (Press)</i>	0.02	0.00	0.09
<i>Issue</i>	0.49	1.00	0.50	<i>Issue</i>	0.59	1.00	0.49
<i>Miss</i>	0.42	0.00	0.49	<i>Miss</i>	0.45	0.00	0.50
<i>OptBias</i>	0.01	0.00	0.12	<i>OptBias</i>	0.01	0.05	0.62
<i>Range</i>	2.62	0.90	5.66	<i>Range</i>	4.97	2.63	8.43
<i>LnAnalysts</i>	2.19	2.30	0.71	<i>LnAnalysts</i>	2.59	2.67	0.50
<i>Inst</i>	0.80	0.82	0.22	<i>Inst</i>	0.70	0.72	0.19
<i>Size</i>	7.9	7.89	2.35	<i>Size</i>	9.46	9.37	1.25
<i>EarnVol</i>	0.51	0.02	4.62	<i>EarnVol</i>	0.02	0.02	0.03
<i>LitRisk</i>	0.05	0.01	0.31	<i>LitRisk</i>	0.03	0.01	0.19
<i>ChgEarn</i>	1.65	0.39	19.09	<i>ChgEarn</i>	0.14	0.03	2.80
<i>MTB</i>	71.02	2.30	813.20	<i>MTB</i>	2.96	2.54	7.77
<i>EquityIssue</i>	0.61	1.00	0.49	<i>EquityIssue</i>	0.57	1.00	0.49
<i>M&amp;A</i>	0.01	0.00	0.10	<i>M&amp;A</i>	0.00	0.00	0.05
<i>Weakness</i>	0.12	0.00	0.33	<i>Weakness</i>	0.10	0.00	0.29
<i>Roa</i>	0.29	0.05	4.01	<i>Roa</i>	0.06	0.05	0.07
<i>Loss</i>	0.10	0.00	0.30	<i>Loss</i>	0.05	0.00	0.22
<i>ShrOwn</i>	0.85	0.00	2.57	<i>SumTotal</i>	59.69	17.00	140.94
<i>Vested</i>	7.76	4.64	9.31	<i>Horizon</i>	382.20	343.00	131.44
<i>Horizon</i>	219.71	235.00	133.04	<i>News</i>	1.00	-0.55	23.90
<i>News</i>	-9.33	-1.63	11.42	<i>Dacc</i>	0.00	0.00	0.04
<i>Dacc</i>	0.00	0.00	0.07	<i>Conc</i>	0.11	0.00	0.32
<i>Conc</i>	0.41	0.37	0.17				

TABLE 4

First-stage estimation of the probability of management forecast issuance

	Predicted sign	Dependent variable = <i>Issue</i>	
		<i>Conf (Holder67)</i>	<i>Conf (Press)</i>
<i>Conf</i>	+	0.002 (0.043)	2.728*** (0.635)
<i>LnAnalysts</i>	+	0.297*** (0.033)	0.106*** (0.007)
<i>Inst</i>	+	0.357*** (0.114)	0.397 (0.265)
<i>Size</i>	+	0.064*** (0.011)	-0.195*** (0.046)
<i>EarnVol</i>	-	-0.015*** (0.004)	-8.577*** (1.745)
<i>LitRisk</i>	-	0.042 (0.059)	0.840 (0.555)
<i>ChgEarn</i>	-	-0.006*** (0.001)	-0.023* (0.014)
<i>MTB</i>	+	0.000 (0.000)	-0.000 (0.006)
<i>EquityIssue</i>	?	-0.145*** (0.043)	0.068 (0.102)
<i>M&amp;A</i>	?	0.304 (0.189)	-1.257 (0.770)
<i>Weak</i>	?	0.058 (0.061)	0.581*** (0.172)
<i>Roa</i>	-	-0.004 (0.005)	-0.835** (0.425)
<i>Loss</i>	-	-1.064*** (0.065)	-0.641*** (0.182)
<i>ShrOwn</i>	?	-0.025*** (0.009)	
<i>Vested</i>	?	0.011*** (0.002)	
<i>SumTotal</i>	?		-0.002*** (0.000)
Pseudo Rsq		0.171	0.183
Observations		13,120	3,298

This table presents results from logit regressions of forecast issuance on overconfidence. *Issue* is a dummy variable equal to one if the firm issued at least one forecast in year *t*, zero otherwise. *Conf*

*(Holder67)* is a dummy variable equal to one if the CEO holds options despite a 67% increase in stock price (or more) at least twice. *Conf (Press)* is defined as the number of articles describing the CEO as optimistic or confident minus the number of articles describing the CEO as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident, scaled by the number of CEO press mentions over the entire sample period. See Appendix for variable definitions. Industry and year fixed effects are included. Robust standard errors are reported in parentheses. \*\*\*, \*\*, and \* indicate 0.01, 0.05, and 0.10 significance levels, respectively.



TABLE 5

Second-stage estimation of the probability of missed forecasts

	Predicted sign	Dependent variable = <i>Miss</i>	
		<i>Conf (Holder67)</i>	<i>Conf (Press)</i>
<i>Conf</i>	+	0.178*** (0.030)	0.841* (0.537)
<i>Inst</i>	-	0.100 (0.077)	-1.838*** (0.194)
<i>Size</i>	-	-0.038*** (0.009)	-0.092** (0.038)
<i>EarnVol</i>	-	-0.022*** (0.005)	-1.619 (1.659)
<i>LitRisk</i>	-	0.601*** (0.168)	-0.005 (0.267)
<i>ChgEarn</i>	-	-0.008*** (0.001)	-0.029 (0.019)
<i>MTB</i>	-	-0.000 (0.000)	-0.011*** (0.003)
<i>EquityIssue</i>	-	-0.067*** (0.033)	0.374*** (0.064)
<i>M&amp;A</i>	-	0.228 (0.162)	-2.337** (1.127)
<i>Weak</i>	?	0.124*** (0.043)	0.365*** (0.100)
<i>Roa</i>	-	-0.016*** (0.004)	-1.647** (0.697)
<i>Loss</i>	+	0.503*** (0.068)	-0.036 (0.202)
<i>Horizon</i>	+	0.003*** (0.000)	0.000 (0.000)
<i>News</i>	+	0.005*** (0.002)	0.019*** (0.003)
<i>Dacc</i>	-	0.371 (0.263)	-0.933 (0.902)
<i>Conc</i>	-	-1.374*** (0.508)	0.286*** (0.104)
<i>InvMills</i>	?	0.710*** (0.160)	0.233* (0.140)
Pseudo Rsq		0.124	0.126
Observations		28,211	7,822

This table presents results from logit regressions of optimistic forecasts on overconfidence. *Miss* is a dummy variable equal to one if actual earnings is less than the management forecast, zero otherwise. *Conf (Holder67)* is a dummy variable equal to one if the CEO holds options despite a 67% increase in stock price (or more) at least twice. *Conf (Press)* is defined as the number of articles describing the CEO as optimistic or confident minus the number of articles describing the CEO as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident, scaled by the number of CEO press mentions over the entire sample period. See Appendix for variable definitions. *ShrOwn*, *Vested*, *SumTotal*, and industry and year fixed effects are included but untabulated. Robust standard errors are reported in parentheses. \*\*\*, \*\*, and \* indicate 0.01, 0.05, and 0.10 significance levels, respectively.

TABLE 6

## Overconfidence and management forecast bias

	Predicted sign	Dependent variable = <i>OptBias</i>	
		<i>Conf (Holder67)</i>	<i>Conf (Press)</i>
<i>Conf</i>	+	0.005*** (0.002)	4.177* (2.763)
<i>Inst</i>	-	-0.009* (0.005)	3.255** (1.429)
<i>Size</i>	-	0.004*** (0.001)	-0.779* (0.404)
<i>EarnVol</i>	-	-0.001*** (0.000)	-3.857** (2.842)
<i>LitRisk</i>	-	0.045*** (0.008)	7.293** (3.534)
<i>ChgEarn</i>	-	-0.000*** (0.000)	-0.119 (0.307)
<i>MTB</i>	-	-0.000 (0.000)	0.048** (0.020)
<i>EquityIssue</i>	-	-0.014*** (0.002)	0.313 (0.457)
<i>M&amp;A</i>	-	-0.045*** (0.011)	-1.640 (2.103)
<i>Weak</i>	?	0.011*** (0.002)	4.943*** (1.060)
<i>Roa</i>	-	-0.000 (0.000)	7.713 (5.078)
<i>Loss</i>	+	0.055*** (0.008)	4.229** (1.998)
<i>Horizon</i>	+	0.000*** (0.000)	0.006* (0.003)
<i>News</i>	+	0.001*** (0.000)	0.420*** (0.038)
<i>Dacc</i>	-	-0.027 (0.019)	-21.901* (13.169)
<i>Conc</i>	-	-0.096*** (0.034)	-0.298 (0.568)
<i>InvMills</i>	?	0.134*** (0.022)	2.596** (1.058)
Pseudo Rsq		0.116	0.270
Observations		28,211	7,822

This table presents results from OLS regressions of forecast optimism on overconfidence. *OptBias*

is defined as the management forecast minus actual earnings, scaled by logged assets per share.

*Conf (Holder67)* is a dummy variable equal to one if the CEO holds options despite a 67% increase in stock price (or more) at least twice. *Conf (Press)* is defined as the number of articles describing the CEO as optimistic or confident minus the number of articles describing the CEO as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident, scaled by the number of CEO press mentions over the entire sample period. See Appendix for variable definitions. *ShrOwn*, *Vested*, *SumTotal*, and industry and year fixed effects are included but untabulated. Robust standard errors are reported in parentheses. \*\*\*, \*\*, and \* indicate 0.01, 0.05, and 0.10 significance levels, respectively.

TABLE 7

Overconfidence and management forecast precision

	Predicted sign	Dependent variable = <i>Range</i>	
		<i>Conf (Holder67)</i>	<i>Conf (Press)</i>
<i>Conf</i>	-	-0.403*** (0.061)	-1.539* (1.001)
<i>Inst</i>	-	-1.465*** (0.210)	-0.066 (0.562)
<i>Size</i>	+	2.427*** (0.069)	2.800*** (0.149)
<i>EarnVol</i>	+	-0.060*** (0.008)	32.863*** (4.865)
<i>LitRisk</i>	?	0.969*** (0.131)	-6.384*** (2.162)
<i>ChgEarn</i>	-	-0.010* (0.006)	-0.193** (0.089)
<i>MTB</i>	-	-0.000** (0.000)	-0.023 (0.017)
<i>EquityIssue</i>	?	-0.234*** (0.080)	0.513*** (0.157)
<i>M&amp;A</i>	?	-1.047*** (0.189)	-0.796 (0.674)
<i>Weak</i>	+	1.355*** (0.109)	1.534*** (0.492)
<i>Roa</i>	?	0.035** (0.014)	10.988*** (2.298)
<i>Loss</i>	+	0.744*** (0.157)	-1.981*** (0.700)
<i>Horizon</i>	+	0.007*** (0.001)	-0.002*** (0.001)
<i>News</i>	+	0.015** (0.006)	28.630*** (8.707)
<i>Dacc</i>	+	4.589*** (0.810)	30.312*** (8.966)
<i>Conc</i>	-	-1.002 (0.886)	2.371*** (0.803)
<i>InvMills</i>	?	6.475*** (0.727)	-2.191*** (0.408)
Pseudo Rsq		0.437	0.420
Observations		24,145	6,411

This table presents results from OLS regressions of forecast precision on overconfidence for range

forecasts. Range is defined as forecast range, scaled by logged assets per share. *Conf (Holder67)* is

a dummy variable equal to one if the CEO holds options despite a 67% increase in stock price (or more) at least twice. *Conf (Press)* is defined as the number of articles describing the CEO as optimistic or confident minus the number of articles describing the CEO as reliable, steady, practical, conservative, frugal, cautious, not optimistic, or not confident, scaled by the number of CEO press mentions over the entire sample period. See Appendix for variable definitions. *ShrOwn*, *Vested*, *SumTotal*, and industry and year fixed effects are included but untabulated. Robust standard errors are reported in parentheses. \*\*\*, \*\*, and \* indicate 0.01, 0.05, and 0.10 significance levels, respectively.

TABLE 8

Alternative measures of overconfidence, 2006-2010

	Dependent variable= <i>Issue</i>	Dependent variable= <i>Miss</i>	Dependent variable= <i>OptBias</i>	Dependent variable= <i>Range</i>
<i>Conf (Holder67_MT)</i>	0.452*** (0.083)	0.104* (0.065)	0.134 (0.194)	-0.316*** (0.073)
<i>LnAnalysts</i>	0.139** (0.067)			
<i>Inst</i>	0.781** (0.305)	-0.651*** (0.225)	0.893 (0.757)	-3.843*** (0.424)
<i>Size</i>	0.091*** (0.030)	-0.164*** (0.023)	-0.733*** (0.088)	1.591*** (0.043)
<i>EarnVol</i>	-0.134** (0.056)	-0.022 (0.083)	0.175 (0.203)	0.046 (0.068)
<i>LitRisk</i>	-0.079 (0.233)	1.720*** (0.217)	12.846*** (1.164)	0.738** (0.293)
<i>ChgEarn</i>	-0.002 (0.001)	-0.007*** (0.002)	-0.062*** (0.011)	-0.005 (0.004)
<i>MTB</i>	-0.012 (0.015)	-0.053*** (0.011)	-0.094** (0.038)	0.127*** (0.013)
<i>EquityIssue</i>	-0.197** (0.081)	-0.071 (0.064)	-0.196 (0.184)	-0.208*** (0.073)
<i>M&amp;A</i>	0.373 (0.340)	0.076 (0.249)	3.815*** (1.016)	-0.015 (0.303)
<i>Weak</i>	-0.026 (0.114)	0.054 (0.083)	0.267 (0.237)	0.192** (0.097)
<i>Roa</i>	-0.018 (0.026)	-0.078*** (0.028)	-0.553*** (0.174)	0.009 (0.062)
<i>Loss</i>	-1.164*** (0.125)	0.911*** (0.125)	1.311*** (0.441)	0.135 (0.150)
<i>Horizon</i>		1.371*** (0.116)	0.660* (0.377)	2.753*** (0.147)
<i>News</i>		0.019*** (0.007)	0.173*** (0.053)	-0.036* (0.020)
<i>Dacc</i>		1.060* (0.641)	4.370** (1.752)	-0.469 (0.646)
<i>Conc</i>		-5.763*** (1.606)	-31.538*** (4.875)	-10.645*** (2.308)
<i>InvMills</i>		-0.990*** (0.297)	-1.416** (0.579)	0.956*** (0.261)
Pseudo Rsq	0.244	0.110	0.182	0.555
Observations	4,148	8,253	8,253	7,271

This table presents results using Execucomp package-level data. The sample consists of 8,253 forecasts from 2006-2010. *Conf (Holder67)* is a dummy variable equal to one if the CEO holds options with five years remaining duration despite a 67% increase in stock price (or more) at least twice. See Appendix for variable definitions. *ShrOwn*, *Vested*, and industry and year fixed effects are included but untabulated. Robust standard errors are reported in parentheses. \*\*\*, \*\*, and \* indicate 0.01, 0.05, and 0.10 significance levels, respectively.