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CEO confidence and stock returns

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ABSTRACT

Consistent with the theoretical predictions of Goel and Thakor (2008), we find that overconfident CEOs create significant value for the firm through superior stock return performance and take more risk, compared to their non-overconfident counterparts. We also differentiate between innovative and non-innovative industries and find for each subsample that overconfident CEOs create firm value. We find these results even when we control for founder CEOs as they add value and make similar corporate policy decisions as overconfident CEOs. Finally, consistent with the predictions of Goel and Thakor (2008), we find that overconfident CEOs are hired less frequently, take less risk, and add less value after the enactment of the Sarbanes–Oxley Act in 2002, which put in place strict penalties for poor quality information disclosures by corporations. This finding has significant implications for empirical study as this paper provides evidence of the important impact the Sarbanes–Oxley Act has on the relation between CEO overconfidence and firm policies.

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1. Introduction and background

Goel and Thakor (2008) and Gervais et al. (2011) use theoretical models and predict that CEO overconfidence can enhance firm value as it tends to mitigate the underinvestment problem. However, Goel and Thakor (2008) also predict that a regulation such as the Sarbanes–Oxley Act in the United States will make boards of directors less likely to hire overconfident CEOs in the face of potential stiff penalties for poor quality information disclosures, which could reduce corporate investment and firm value due to greater underinvestment. Given these theoretical predictions, in this study we investigate whether CEO overconfidence can add value to the firm and whether the enactment of the Sarbanes–Oxley Act had an effect on the relation between CEO overconfidence and firm value.

An extensive literature provides strong evidence that CEO overconfidence influences key corporate policies.¹ Overconfident managers have greater investment-cash flow sensitivity, pay lower dividends, use less external financing, make larger investments in CAPEX and innovation, and have a higher propensity for value-destructive acquisitions, relative to their peers (Ben-David et al., 2007; Billett and Qian, 2008; Deshmukh et al., 2013; Hirshleifer et al., 2012; Malmendier and Tate, 2005, 2008; Malmendier et al., 2011). CEO overconfidence also indicates rosier earnings projections, earnings management, and

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¹ Overconfidence is the tendency to overestimate expected future cash flows and/or underestimate the risk of the cash flows, relative to a non-overconfident peer. However, all CEOs are considered rational, irrespective of their confidence level. It is also important to note that while we use the term overconfidence to be consistent with the terminology most commonly used in the literature, the term overconfidence has also been referred to in the literature as optimism, hubris, and simply confidence (e.g., Graham et al., 2013; Hayward and Hambrick, 1997; Puri and Robinson, 2007). While the term overconfidence may be viewed by some to have negative connotations, it is not necessarily meant to be an undesirable trait in the context that it is used in the literature.

financial fraud (e.g., [Hribar and Yang, 2015](#); [Schrand and Zechman, 2012](#)). It is important to note that while the above findings are consistent with an aggressive policy profile for overconfident CEOs, most of the above policy choices cannot be unequivocally construed to be value additive, or destructive for that matter.

In terms of the realized firm value implications of managerial overconfidence, two recent studies provide some indirect evidence. [Hirshleifer et al. \(2012, p. 1491\)](#) (henceforth HLT) ask whether “overconfidence allows firms to translate growth opportunities into realized firm value.” They find that overconfidence is associated with higher Tobin’s q in the presence of industry growth opportunities, but only in innovative industries. [Chen et al. \(2014\)](#) (henceforth CHH) instead focus their inquiry on firms that significantly increase R&D (limiting their inquiry significantly to involve 139 firm-year observations). They find that “... following a significant increase in R&D, investors in firms whose CEOs do not exhibit overconfidence earn abnormal returns ...” (p. 265). Further, CHH finds overconfident managers in high-tech industries (essentially equivalent to HLT’s innovative industries) underperform in terms of abnormal stock returns.

While the results of CHH seem contradictory to those of HLT, the authors answer two specific questions. HLT ask whether CEO overconfidence is associated with higher valuation multiples (not value-added) in the presence of growth opportunities, while CHH conditionally test if CEO overconfidence is associated with future abnormal returns following significant increases in R&D.

We contribute to the literature by directly testing whether CEO overconfidence results in value creation for the firm. To avoid endogeneity, we study risk-adjusted future stock returns to test for this, similar to CHH; however, we significantly broaden the scope of our inquiry by considering the performance of all firms led by overconfident and non-overconfident CEOs in the Compustat Executive Compensation Database (ExecuComp), as opposed to merely those few observations following significant increases in R&D spending. Given the findings in HLT, we also investigate whether there is a systematic difference in the link between CEO overconfidence and firm value addition across innovative and non-innovative industries (see also, [Galasso and Simcoe, 2011](#)).

We also contribute to the literature by conducting several additional tests. First, we test a theoretical prediction of [Goel and Thakor \(2008\)](#) related to the potential effect of the Sarbanes–Oxley Act (Sarbox) on the value implications of managerial overconfidence. [Goel and Thakor \(2008\)](#) show that CEO overconfidence can be beneficial to firm performance as it counteracts managerial risk aversion and alleviates the underinvestment problem. However, in their model, overconfident CEOs also underinvest in information production, leading to poorer quality information disclosures. This may pose a problem with the enactment of Sarbox in 2002 as it implemented clear and significant penalties to motivate higher quality disclosures. As [Goel and Thakor \(2008, p. 2771\)](#) note, “from Corollary 2 we get the prediction that Sarbox should lead to a lower incidence of overconfidence among CEOs, and lower aggregate investment.” This predicted exacerbation of the underinvestment problem by Sarbox could therefore result in a lower degree of value creation as opposed to what could prevail in the absence of the law. In sum, Sarbox could have a significant impact on the proportion of overconfident managers, which may reduce the degree of value creation. Thus, we examine whether the proportion of overconfident CEOs and the degree of value creation differs in the period following the enactment of Sarbox (2004–2010) relative to the period prior (1992–2001).

Next, we also include founder CEO status in our analysis as [Fahlenbrach \(2009\)](#) demonstrates that founder CEOs (11% of the sample) invest significantly more in R&D and CAPEX, make more acquisitions, and create more firm value relative to other CEOs. Clearly, founder CEOs appear similar to overconfident CEOs in key policy choices. Therefore, including the founder CEO indicator variable in our model allows us to control for the known value-creation effects of a founder CEO. Further, it gives us an opportunity to investigate whether founder CEOs manage to create firm value, independent of overconfidence, as [Fahlenbrach \(2009\)](#) does not control for overconfidence.

Additionally, as the framework of [Goel and Thakor \(2008\)](#) hinges on information production, which often falls under the supervision of the CFO, we also examine whether CFO overconfidence adds further value to the firm. Finally, [Zhang \(2006\)](#) shows that information asymmetry is important for short-term return continuation. In our study, this continuation could appear as value created by overconfident CEOs. We show the robustness of our results to a set of information asymmetry variables ([Zhang, 2006](#)), which have not been controlled for in the extant empirical literature on CEO overconfidence.

Our findings support the theoretical value-additive predictions of [Goel and Thakor \(2008\)](#) and [Gervais et al. \(2011\)](#). We find that a company experiences economically significant, superior risk-adjusted stock return performance with an overconfident CEO compared to a non-overconfident peer. Depending on the stock return measure (buy-and-hold abnormal returns or calendar-time return), the forward one-year return for overconfident CEO-led firms is between 3.00 and 3.50 percentage points higher compared to firms led by non-overconfident CEOs. Further, we find that overconfident CEO-led firms demonstrate higher stock return volatility than non-overconfident CEO-led firms, supporting the evidence in HLT. In addition, we find that CEO overconfidence is strongly linked to value creation in innovative as well as non-innovative industries. Controlling for CEO overconfidence, we find only weak evidence that founder CEO status adds incremental value to the firm. Next, consistent with the implication of [Goel and Thakor \(2008\)](#), following the enactment of Sarbox, overconfident CEOs are hired less frequently, take less risk, and add less value as the Act implemented strict penalties for poor quality information disclosures. We also find that CFO overconfidence does not add marginal value to the firm in the presence of a non-overconfident CEO, although it does so when paired with an overconfident CEO. Finally, we demonstrate that our result that CEO overconfidence adds value to the firm is robust to information asymmetry between the firm and the investor.

Taken together, our findings contribute to several aspects of the literature. In addition to the contribution to the broader literature on the relation between CEO overconfidence and corporate policy decisions, our findings contribute directly to the theoretical and empirical literature regarding CEO overconfidence and firm value. Our findings also contribute to the

literature on the intended and potentially unintended effects of Sarbox. Specifically, our findings support the direct theoretical predictions of [Goel and Thakor \(2008\)](#) that the effect of overconfidence on firm value is importantly different following the enactment of Sarbox. This has important implications for future empirical analysis of CEO overconfidence and firm policy as researchers to this point have not considered the important effects Sarbox could have on this dynamic. We also contribute to the literature on founder CEOs and firm policy and value by providing evidence that, despite sharing characteristics similar to overconfident CEOs, founder CEOs create limited additional value.

The rest of the paper proceeds as follows. In [Section 2](#), we provide a literature review and develop our hypotheses. A description of the sample and summary statistics are provided in [Section 3](#), while in [Section 4](#) we discuss our estimation methods and empirical findings. We discuss robustness tests in [Section 5](#) and conclude in [Section 6](#).

2. Literature review and hypotheses development

HLT (p. 1458) define CEO overconfidence as the tendency “to overestimate the net discounted payoffs from uncertain endeavors ...” that can be attained through overestimating expected future cash flows and/or underestimating the risk of the future cash flows. Ordinary individuals as well as experts are generally overconfident about themselves and this overconfidence increases as the task becomes more complex or difficult (e.g., [Griffin and Tversky, 1992](#)).² However, overconfidence does not necessarily invoke irrationality (e.g., [Gervais et al., 2011](#)) and it is distinct from risk aversion ([Malmendier and Tate, 2005](#)). We should also note that two alternative definitions of overconfidence exist. First, overconfidence is sometimes defined as a higher subjective estimate of signal precision, leading to a lower estimate of volatility (e.g., [Daniel et al., 1998](#); [Gervais et al., 2011](#); [Goel and Thakor, 2008](#); [Hackbarth, 2008](#)). Second, the tendency to overestimate cash flows is sometimes defined as optimism ([Campbell et al., 2011](#); [Hackbarth, 2008](#)). Clearly, the definition proposed by HLT and [Malmendier and Tate \(2005\)](#) subsumes both alternative definitions, and is empirically appealing as empirical literature generally concerns itself with an overestimation of value, not its individual components.

[Bertrand and Schoar \(2003, p. 1169\)](#) are among the first to show that “manager fixed effects matter for a wide range of corporate decisions.” Subsequently, [Malmendier and Tate \(2005\)](#), motivated by the theoretical prediction of [Heaton \(2002\)](#), show that CEO overconfidence leads to corporate investments that are more sensitive to cash flows. [Malmendier et al. \(2011\)](#) show that overconfident managers issue less equity and underutilize debt, while [Deshmukh et al. \(2013\)](#) show that overconfidence leads to lower dividend payouts (see also [Ben-David et al., 2007](#), on dividends and repurchases). [Malmendier and Tate \(2008\)](#) show that CEO overconfidence results in a greater propensity for value-reducing acquisitions (see also [Huang and Kisgen, 2013](#)), and [Hribar and Yang \(2015\)](#) find that it is related to earnings management. On the other hand, CEO overconfidence also leads to greater innovation (see, e.g., [Galasso and Simcoe, 2011](#); HLT). Optimism, similar to overconfidence, has also been shown to affect economic decisions for individuals and CEOs ([Graham et al., 2013](#); [Puri and Robinson, 2007](#)).

Clearly an extensive literature has developed on the effects of managerial overconfidence on corporate policies, but to our knowledge there are only two empirical studies indirectly related to managerial overconfidence and firm value. On the one hand, HLT show that overconfidence enables CEOs to convert growth opportunities into firm value (measured by Tobin's q), but only in innovative industries. On the other hand, CHH find that, for a sample of 139 firm-years of significant increases in R&D expenses, only firms run by non-overconfident CEOs earn positive abnormal returns following an increase in R&D. Unlike HLT's positive result for innovative industries, high-tech firms with overconfident CEOs actually garner strongly negative abnormal returns, relative to non-overconfident CEOs. While these two studies are the closest in the literature to address the effect of CEO overconfidence on firm value, neither specifically examines the theoretical hypothesis that CEO overconfidence adds firm value. This gives rise to the apparent contradiction in their results. In our study, we specifically address whether CEO overconfidence adds value to the firm, not whether it is associated with a greater valuation multiple (Tobin's q) or whether the R&D decisions of overconfident CEOs are suboptimal.

As noted above, we study a common measure of value added – the firm's future abnormal stock performance (alpha) – following demonstration of CEO overconfidence. Under efficient markets, the stock price of a firm should immediately react to the public information of the CEO's confidence level, and the risk-adjusted future stock returns should be independent of publicly available information. Consequently, future risk-adjusted returns should be free of any endogeneity stemming from CEO overconfidence (e.g., optimal matching of CEO overconfidence to firm needs in [Cronqvist et al., 2012](#)). Our first null hypothesis follows in the traditional agnostic manner.

H1. *Ceteris paribus*, there is no difference in risk-adjusted stock return performance between overconfident CEO-led firms and non-overconfident CEO-led firms.

The null hypothesis on risk levels follows as below.

H2. *Ceteris paribus*, there is no difference in stock return volatility between overconfident CEO-led firms and non-overconfident CEO-led firms.

² See [Malmendier and Tate \(2005\)](#) and HLT for excellent reviews of the social psychology literature.

Graham et al. (2013) suggest that overconfident CEOs are more likely to run growth companies while HLT argue that overconfident CEOs are more likely to be found in innovative industries. Indeed, Galasso and Simcoe (2011) and HLT show that CEO overconfidence leads to greater investment in innovation with a measurable difference in output in the form of patents. Also, HLT show that CEO overconfidence is material for patent counts in innovative industries but not in non-innovative industries, and overconfident CEOs are better able to exploit growth opportunities in innovative industries. Therefore, additional null hypotheses follow analogously.

H3. *Ceteris paribus*, there is no difference in risk-adjusted stock return performance between overconfident CEO-led firms and non-overconfident CEO-led firms in innovative industries.

H4. *Ceteris paribus*, there is no difference in risk-adjusted stock return performance between overconfident CEO-led firms in innovative industries and overconfident CEO-led firms in non-innovative industries.

Next, from the board's perspective, while CEO overconfidence mitigates the risk aversion driven underinvestment problem, it also exposes the firms to potential penalties as an overconfident CEO typically underinvests in information production, which leads to poorer quality information disclosures (Goel and Thakor, 2008). With the enactment of Sarbox, clear and significant penalty provisions were put in place, making boards relatively less partial to overconfident CEOs in comparison to their non-overconfident counterparts (Corollary 2 of Goel and Thakor, 2008). Two empirical implications follow. First, as Goel and Thakor (2008, p. 2771) note, "[S]arbox should lead to a lower incidence of overconfidence among CEOs." Second, as their discussion of Corollary 2 indicates, "... anticipation of this penalty increases the CEO's investment in information precision" (p. 2769). This affects the underinvestment problem. First, overconfident CEOs could become less overconfident, in the face of potential higher penalties. Next, boards of directors may become more circumspect with the increased possibility of higher potential penalties and will be less likely to hire overconfident CEOs. The effect of these two changes will essentially lead to a more aggravated underinvestment problem, which should have a downward impact on firm value. Therefore, the implication would be that overconfident CEOs add less value in the post-Sarbox period compared to the pre-Sarbox period. The magnitude of this potential decline in firm value creation will depend on investors' expectations of additional Sarbox-mandated penalties, if one were to assume the underinvestment problem to be time-invariant in terms of its frequency and its opportunity cost.

An alternative explanation applies if CEO overconfidence is assumed to be continuous, not binary. Then, in the face of potential penalties, pre-Sarbox overconfident CEOs may behave in a less overconfident manner in the post-Sarbox period. This may lead to a lower degree of value creation, which now will depend on expected Sarbox penalties and the opportunity cost of greater underinvestment by less overconfident CEOs. Two null hypotheses follow.

H5. There must be an equal proportion of overconfident CEOs in the post-Sarbox period compared to the pre-Sarbox period.

H6. *Ceteris paribus*, there is no difference in the relative risk-adjusted stock return performance between overconfident CEO-led firms and non-overconfident CEO-led firms in the pre-Sarbox period relative to the post-Sarbox period.

Finally, the above predictions of Goel and Thakor (2008) crucially depend on the issue of information production and disclosure, which falls into the domain of the CFO. Further, investments by an overconfident CEO require financing and securing financing is typically an integral part of the CFO's responsibilities. Indeed, prior studies show that CFOs influence a broad swath of accounting choices and investment decisions (see, e.g., Ben-David et al., 2007; Ge et al., 2011). Therefore, one must entertain a clear possibility that CFO overconfidence may also affect value creation. However, Feng et al. (2011, p. 21) produce strong evidence "that CFOs are involved in material accounting manipulations because they succumb to pressure from CEOs, rather than because they seek immediate personal financial benefit from their equity incentives." Also, CEOs, not CFOs, make investment decisions. Therefore, it is uncertain whether CFOs' overconfidence will marginally add value to the firm if the CEO is non-overconfident. On the other hand, CFO overconfidence could perhaps add value when it is reinforced by CEO overconfidence. This discussion provides the final hypotheses as stated below.

H7. CFO overconfidence will not marginally add value to the firm if the CEO is non-overconfident.

H8. CFO overconfidence will not marginally add value to the firm if the CEO is overconfident.

3. Sample construction, data description, and descriptive statistics

3.1. Sample construction

The initial database used to construct our sample is Standard and Poor's ExecuComp Database, which provides executive compensation information. We collect data on each CEO's stock option portfolio for each year from 1992 to 2010, leaving out only CEOs of utilities and financial companies. This results in 25,014 CEO-firm-year observations. Accounting data re-

trieved from Compustat and stock return data retrieved from CRSP is then merged into the ExecuComp dataset to generate the additional data necessary for our analyses.

In our analyses, we control for firm variables commonly included in regressions of firm stock performance and stock volatility. Of particular importance to our study, we control for the pay-performance sensitivity of a CEO's compensation portfolio by controlling for vega and delta. Vega is defined as the dollar value change in the CEO's option portfolio wealth for a 1% change in annualized stock return volatility. Delta is the dollar value change in the CEO's stock and option portfolio for a 1% change in the stock's price. Thus, these two variables control for the effect compensation has on corporate policy decisions and risk-taking by the CEO that may affect the firm's stock performance (e.g., [Bansal et al., 2013](#); [Chava and Purnanandam, 2010](#); [Coles et al., 2006](#)). Both of these measures are computed using the [Core and Guay \(2002\)](#) one-year approximation. Variable definitions of the other control variables are in the Appendix.

We also study the impact of CEO overconfidence on firm value based on the type of company the CEO manages. In particular, overconfident managers are more likely to run growth and innovative companies and that their impact will be greatest in these particular industries (e.g., [Graham et al., 2013](#); HLT; [Galasso and Simcoe, 2011](#)). We follow HLT and identify a firm as being in an innovative industry if the firm falls under HLT's innovative classification in at least 80% of sample years.

3.2. CEO overconfidence identification

We use stock option exercise behavior to identify CEO overconfidence. With risk aversion, an undiversified CEO should rationally exercise stock options once the options are deep-in-the-money ([Hall and Murphy, 2002](#)). This is consistent with the present interest in applying utility-based models to price executive option grants as these options are commonly exercised well before maturity, and often immediately after vesting once they are deep-in-the-money ([Bettis et al., 2005](#)). Using [Hall and Murphy's \(2002\)](#) moneyness-based exercise bounds, [Malmendier and Tate \(2005, 2008\)](#) define a CEO as overconfident if she continues to hold stock options that are more than 67%. A key distinction between Malmendier and Tate's approach and ours is that they employ the more detailed but dated [Hall and Liebman \(1998\)](#) dataset, which enables them to look at the moneyness of each individual option grant. Given that we employ ExecuComp for its length, breadth, and currency, we follow a variant developed by [Core and Guay \(2002\)](#), which has been used extensively in the literature (see, e.g., [Campbell et al., 2011](#); CHH; HLT). Our use of this method, however, requires more details.

[Malmendier and Tate \(2005\)](#), in their pioneering study, define a variable, *HOLDER67*, which is assigned to a CEO who carries greater than 67% moneyness, exercisable options for the second time. [Malmendier and Tate \(2005, p. 2672\)](#) find that this measure targets "permanent" CEO overconfidence consistent with a personality trait, rather than its "transitory" component. However, in [Malmendier and Tate \(2008\)](#) and [Malmendier et al. \(2011\)](#), they determine that the CEO is overconfident after only the first failure to exercise an exercisable greater than 67% in-the-money position. Most studies subsequent to [Malmendier and Tate \(2008\)](#) have followed this single incidence-based measure (e.g., [Campbell et al., 2011](#); CHH; HLT).

Consistent with HLT and [Malmendier and Tate \(2005, 2008\)](#) *inter alia*, we classify CEOs into two categories: overconfident and non-overconfident. However, we classify a CEO as overconfident for all future years when she carries an exercisable option portfolio with aggregate moneyness exceeding 67% for the second time. Thus, we choose the more stringent threshold and do so to ensure that we are not capturing transitory overconfidence based on market conditions. This stringency is particularly important as we examine abnormal performance in future stock returns, and the empirical measure of overconfidence also happens to be based on past stock performance. CEOs that have exercisable options of aggregate moneyness over 67% only once or never are classified as non-overconfident throughout the sample. For example, we clarify the procedure of classifying a CEO as overconfident with the case of a CEO whose tenure was 2000–2010, but who was first identified as overconfident in 2003 and next in 2005. Here we classify the post-identification period of CEO overconfidence as the period following the second incidence of overconfidence (2006–2010), while most studies would have classified her as overconfident from 2004 onward.

Also, in all the studies known to us, the same overconfident CEO is classified as non-overconfident in the pre-identification period. Although this treatment of the pre-identification period is at odds with overconfidence being an immutable trait, the statistical logic is obvious. Holding deep-in-the-money options infers CEO overconfidence, but the moneyness factor is likely due to the fact that the CEO employed aggressive policies in the past. More specifically, in our context, high abnormal stock returns in the pre-identification period will increase the probability of the CEO being classified as overconfident through deep-in-the-money options. Thus, classifying the CEO as overconfident in the pre-identification period, as dictated by the persistent trait argument, will bias the study toward finding support that CEO overconfidence leads to abnormal performance. Equally important, classifying the CEOs as non-overconfident in the pre-identification period, as is common practice, will bias the study toward not finding abnormal performance due to CEO overconfidence.

We can easily avoid biasing our results in either direction by distinguishing between the pre-identification and post-identification periods of overconfidence through the use of two indicator variables, one for overconfidence in the pre-identification period and one for overconfidence in the post-identification period, to remove the bias in our tests of abnormal stock return performance. Thus, in the example above, we classify the CEO as pre-overconfident in years 2000–2005 while most studies would have classified the CEO as non-overconfident had they been following our two-incidence assignment of overconfidence. With that said, the interpretation of our results with regard to our hypotheses will focus only on the post-identification indicator variable as it captures the ex post stock return performance. As argued above, we expect to find strong performance in the pre-identification period as it is endogenous in high past abnormal returns. This reasoning

also motivates our choice to conservatively classify a CEO as overconfident only after the CEO carries forward a deep-in-the-money options portfolio for the second time, as the market should have known the CEO to be overconfident by that time. Thus, the post-identification indicator variable suffers from no such endogeneity and should be expected to have a theoretical zero value under the null hypothesis.

3.3. Stock return performance measures

To determine the effect of CEO overconfidence on firm value, we focus on stock return performance as our measure of firm value. This helps alleviate the endogeneity concerns prevalent with studies that attempt to tie firm value to overconfidence (e.g., HLT). The idea here is that once markets perceive a CEO's level of confidence, this will be priced by the market. Thus, future risk-adjusted stock returns should be free from endogeneity and capture the effect of the CEO's overconfident policies on firm performance. We also consider the effect of overconfidence on firm risk, which is measured by daily stock return volatility over the following fiscal year.

We measure firm stock return performance using three buy-and-hold stock return measures. First, we use a stock's fiscal year buy-and-hold raw return (*1-Year B-H*). Second, we use the intercept (*FF4 Intercept*) from a regression of a stock's 12 monthly stock returns over the fiscal year on the Fama and French's (1992) three factors (market return, firm size, and book-to-market) and Carhart's (1997) momentum factor. Our final measure of stock return performance is a risk-adjusted one-year buy-and-hold return (henceforth, abnormal return) where adjustment is done with the Fama–French 10 × 10 portfolios based on size and book-to-market as the benchmark (*1-Year B-H FF 10x10*).

For the sake of robustness, in addition to the three buy-and-hold return measures, we also calculate calendar time monthly returns for portfolios of firms based on CEO overconfidence (e.g., Mitchell and Stafford, 2000). Returns are equally weighted and CEOs are assigned to portfolios based on their overconfidence classification. The portfolio returns are then regressed on the four risk factors mentioned above and dummy variables for CEO overconfidence.

3.4. Descriptive statistics

In Table 1, we report the descriptive statistics. Consistent with Goel and Thakor's (2008) prediction of the pervasiveness of CEO overconfidence, 49% of CEO-firm-year observations are identified as being overconfident in Table 1, Panel A. Thirty-eight percent of the CEO-firm-years fall in the post-identification period, which is expectedly lower than the 61% reported by HLT, because we classify a CEO as overconfident only after the second incidence of overconfidence. Our finding that one-third of the CEOs are overconfident also accords well with Graham et al. (2013, p. 103), who conclude that CEOs are “significantly more optimistic and risk-tolerant than the lay population.” We also find that 11% of the CEO firm-year observations in our sample comprised founders, similar to Fahlenbrach (2009).³

As shown in Table 1 (Panel A), 57% of CEO-firm-year observations are identified as belonging to companies in innovative industries. Also, of the CEO-firm-year observations in innovative industries, nearly 39% involve CEOs identified as being overconfident in the post-identification period while the corresponding number is only slightly lower (36%) in non-innovative industries (Table 1, Panel B). This shows that, in our sample, overconfident CEOs are nearly as likely to be found in innovative or non-innovative industries.⁴ As we speculated earlier, founder CEOs have a very high likelihood of being overconfident, with fully 59% of CEO-firm-years for founders being overconfident in the post-identification period. This statistic underscores the importance of including overconfidence in any study of founders and their corporate policies.

Regarding our return measures, over the entire sample, the average annual raw return is 16.12% and the four-factor model yields a 0.39% intercept on monthly returns, which is statistically insignificant at conventional levels. The average abnormal return using the Fama–French 10 × 10 adjustment is 3.80% on an annual basis. Lastly, the descriptive statistics of the control variables used here are generally similar to their counterparts in the HLT study.

4. Estimation methods and empirical results

4.1. Overconfidence, value creation, and risk taking

As discussed previously, our first and second hypotheses are motivated by the predictions of theoretical models developed by Gervais et al. (2011) and Goel and Thakor (2008). We test whether overconfident CEOs generate greater stock return performance (H1) and volatility (H2) than their non-overconfident counterparts by estimating the following models:

³ Founder CEO data from 1992 to 2002 were provided by Rudiger Fahlenbrach. We hand-collected the founder CEO data for the rest of the sample using an identical methodology to that used by Fahlenbrach (2009).

⁴ As a robustness test of our results based on innovative industries, we also examine the effect of CEO overconfidence in high-tech industries, as defined by Loughran and Ritter (2004). Only 21% of CEO-firm year observations fall under this high-tech industry designation. Overconfident CEOs in the post-identification period occur more frequently in high-tech firms as opposed to non-high-tech firms (44% vs. 36%).

Table 1
Descriptive statistics.

Panel A						
	N	Mean	Std. Dev.	25th percentile	Median	75th percentile
FF4 intercept (monthly)	20,007	0.0039	0.0517	−0.0189	0.0028	0.0244
Raw return (annual)	20,007	0.1612	0.7177	−0.1733	0.0788	0.3520
Abnormal return (annual)	19,980	0.0380	0.7090	−0.2781	−0.0413	0.2212
Daily stock return volatility (%)	24,025	2.81	1.41	1.86	2.47	3.38
PreOverconf CEO	25,014	0.11	0.30	0	0	0
PostOverconf CEO	25,014	0.38	0.48	0	0	1
Founder CEO	20,871	0.11	0.31	0	0	0
High-tech industry (dummy)	25,014	0.21	0.41	0	0	0
Innovative industry (dummy)	25,014	0.57	0.49	0	1	1
Sales (millions)	24,932	4450.02	13,803.15	402.97	1106.08	3391.13
PPE/Emp	24,688	167.95	967.65	20.72	38.78	81.75
Tobin's q	24,931	2.08	2.17	1.21	1.60	2.31
Sales growth	24,782	0.08	0.31	−0.01	0.08	0.18
ROA	24,890	0.12	0.18	0.08	0.13	0.19
Book leverage	24,901	0.23	0.93	0.06	0.20	0.33
Cash	24,972	0.15	0.18	0.02	0.07	0.21
Firm age	23,837	23.25	15.49	10	19	36
CPIMC (millions)	23,996	6510.76	21,357.10	481.14	1265.86	10,001.52
CVOL	22,851	0.0869	0.5431	0.0311	0.0573	0.0854
SIGMA	22,396	0.1131	0.0702	0.0691	0.0962	0.1374
Moneyness	24,007	0.7902	1.6390	0.0314	0.3335	0.9766
CEO tenure (months)	25,014	81.87	85.16	23	56	108
CEO delta	24,263	899,055.24	6,868,342.72	81,323.82	208,277.99	538,508.12
CEO vega	24,263	186,490.01	399,785.99	23,269.27	66,840.23	182,288.68

Panel B			
	N	PreOverconf CEO	PostOverconf CEO
Innovative	14,258	0.10	0.39
Non-innovative	10,756	0.10	0.36
Founder CEO	2296	0.10	0.59

Note: This table provides descriptive statistics. The sample consists of firms (excluding financial and utility companies) in the ExecuComp database from 1992 to 2010. Accounting data and stock returns data (1990 to 2010) are collected from Compustat and CRSP, respectively. *PostOverconf CEO* (*PreOverconf CEO*) is a dummy variable equal to 1 in the years after (in the year of and before) a CEO is identified as having unexercised exercisable options that are at least 67% in the money, on average, for a second time. *Non-Overconf CEO* is defined as a CEO that never has exercisable options that are more than 67% in the money, on average. Panel B provides a breakdown of *Pre-* and *PostOverconf CEO* within the innovative and non-innovative subsamples, as well as in the subsample of founder CEOs. See the Appendix for variable descriptions.

$$\begin{aligned}
 \text{retPerformance}_{i,t} = & \beta_1 \text{PreOverconf}_{i,t-1} + \beta_2 \text{PostOverconf}_{i,t-1} \\
 & + \sum \beta_j (\text{Controls})_{i,t-1} + \sum (\beta_k \text{Industry}_i) \\
 & + \sum (\beta_n \text{Year}_t) + \varepsilon_{i,t}
 \end{aligned} \tag{1A}$$

$$\begin{aligned}
 \text{retVolatility}_{i,t} = & \beta_1 \text{PreOverconf}_{i,t-1} + \beta_2 \text{PostOverconf}_{i,t-1} \\
 & + \sum \beta_j (\text{Controls})_{i,t-1} + \sum (\beta_k \text{Industry}_i) \\
 & + \sum (\beta_n \text{Year}_t) + \varepsilon_{i,t}
 \end{aligned} \tag{1B}$$

where $\text{retPerformance}_{i,t}$ is the dependent variable for firm i in year t for our three return measures and represents *FF4 Intercept*, *1-Year B-H*, and *1-Year B-H FF 10x10*, respectively. $\text{retVolatility}_{i,t}$ is measured as the standard deviation of daily stock returns for firm i in year t . *PostOverconf* (*PreOverconf*) *CEO* is a dummy variable equal to one in the years after (in the years of and before) a CEO is identified as having unexercised exercisable options that are at least 67% in-the-money, on average, for a second time; otherwise, this variable is equal to zero. We control for CEO overconfidence prior to its identification to avoid potential bias in favor of finding a result (if treating CEO overconfidence as an immutable trait) or against finding a result (treating overconfident CEOs prior to identification as non-overconfident). Again, we only consider the indicator variable for overconfidence in the post-identification period when interpreting the results as overconfidence in the pre-identification period is endogenous in high abnormal returns. Given these two dummy variables (*PostOverconf CEO* and *PreOverconf CEO*) in the specification, the non-overconfident CEOs form the base case in our analysis.

We use a set of control variables that can be classified into two major categories: the company-specific information and the CEO-related information. The information on the company includes the log of sales, the log of the ratio of property, plant, and equipment to the number of employees ($\log(\text{PPE}/\text{Emp})$), lagged stock return, Tobin's q , sales growth, return on assets

(ROA), book value of leverage, and cash. On the CEO side, we control for the natural logs of one plus tenure, one plus delta, and one plus vega. This set of controls is similar to those employed in other studies (see, e.g., table 5 of HLT). Finally, we also include variables for industry and year fixed effects.

As noted in the introduction, founder CEOs are known to add more value relative to their non-founding counterparts (Fahlenbrach, 2009). As founders are often viewed as overconfident and 59% of founder observations are classified as overconfident in the post-identification period in our sample, overconfidence might actually proxy for founder status. Thus, we test whether CEO overconfidence adds firm value by estimating the exact specifications in (1A) and (1B) above, but with the addition of an indicator variable (*FounderCEO*) that is equal to one in years where the firm's CEO is a founder. We also interact this indicator with CEO overconfidence in the models as follows:

$$\begin{aligned} \text{retPerformance}_{i,t} = & \beta_1 \text{PreOverconf}_{i,t-1} + \beta_2 \text{PostOverconf}_{i,t-1} \\ & + \beta_3 \text{FounderCEO}_{i,t-1} \\ & + \beta_4 \text{PreOverconf}_{i,t-1} * \text{FounderCEO}_{i,t-1} \\ & + \beta_5 \text{PostOverconf}_{i,t-1} * \text{FounderCEO}_{i,t-1} \\ & + \sum \beta_j (\text{Controls})_{i,t-1} + \sum (\beta_k \text{Industry}_i) \\ & + \sum (\beta_n \text{Year}_t) + \varepsilon_{i,t} \end{aligned} \quad (2A)$$

$$\begin{aligned} \text{retVolatility}_{i,t} = & \beta_1 \text{PreOverconf}_{i,t-1} + \beta_2 \text{PostOverconf}_{i,t-1} \\ & + \beta_3 \text{FounderCEO}_{i,t-1} \\ & + \beta_4 \text{PreOverconf}_{i,t-1} * \text{FounderCEO}_{i,t-1} \\ & + \beta_5 \text{PostOverconf}_{i,t-1} * \text{FounderCEO}_{i,t-1} \\ & + \sum \beta_j (\text{Controls})_{i,t-1} + \sum (\beta_k \text{Industry}_i) \\ & + \sum (\beta_n \text{Year}_t) + \varepsilon_{i,t} \end{aligned} \quad (2B)$$

4.2. Overconfidence, value creation, and risk-taking in innovative and non-innovative industries

The results of Galasso and Simcoe (2011) and HLT show that overconfident CEOs are better at generating innovation and in converting growth opportunities into firm value only for innovative industries, thus motivating our hypotheses 3 and 4. We next test whether there are systematic differences in CEO overconfidence adding value or increasing stock return volatility across innovative and non-innovative industries by estimating the following models:

$$\begin{aligned} \text{retPerformance}_{i,t} = & \beta_1 \text{PreOverconf}_{i,t-1} + \beta_2 \text{PostOverconf}_{i,t-1} \\ & + \beta_3 \text{FounderCEO}_{i,t-1} + \beta_4 \text{Innov}_{i,t-1} \\ & + \beta_5 \text{PreOverconf}_{i,t-1} * \text{Innov}_{i,t-1} \\ & + \beta_6 \text{PostOverconf}_{i,t-1} * \text{Innov}_{i,t-1} \\ & + \sum \beta_j (\text{Controls})_{i,t-1} + \sum (\beta_k \text{Industry}_i) \\ & + \sum (\beta_n \text{Year}_t) + \varepsilon_{i,t} \end{aligned} \quad (3A)$$

$$\begin{aligned} \text{retVolatility}_{i,t} = & \beta_1 \text{PreOverconf}_{i,t-1} + \beta_2 \text{PostOverconf}_{i,t-1} \\ & + \beta_3 \text{FounderCEO}_{i,t-1} + \beta_4 \text{Innov}_{i,t-1} \\ & + \beta_5 \text{PreOverconf}_{i,t-1} * \text{Innov}_{i,t-1} \\ & + \beta_6 \text{PostOverconf}_{i,t-1} * \text{Innov}_{i,t-1} \\ & + \sum \beta_j (\text{Controls})_{i,t-1} + \sum (\beta_k \text{Industry}_i) \\ & + \sum (\beta_n \text{Year}_t) + \varepsilon_{i,t} \end{aligned} \quad (3B)$$

In (3A) and (3B) we simply add a dummy variable to the models to account for companies in innovative industries. *Innov* is equal to one if the firm is identified as being in an innovation industry based on HLT definitions; otherwise, the dummy is equal to zero. We then interact *Innov* with both *PreOverconf CEO* and *PostOverconf CEO* to determine whether the effect on firm stock return performance (volatility) due to CEO overconfidence is significantly different for firms in innovative industries relative to firms in non-innovative industries.

4.3. Overconfidence, value creation, and risk-taking after the passage of Sarbox

According to predictions of Goel and Thakor (2008), under Sarbox firms that do not provide higher quality information disclosures will be penalized. Thus, boards of directors may become relatively less partial to overconfident CEOs under Sarbox. Thus, to test whether Sarbox has a significant impact on the ability of overconfident CEOs to create additional firm value or their willingness to take additional risk, we estimate the following models:

$$\begin{aligned}
retPerformance_{i,t} = & \beta_1 PreOverconf_{i,t-1} + \beta_2 PostOverconf_{i,t-1} \\
& + \beta_3 FounderCEO_{i,t-1} + \beta_4 PostSarbox_{i,t-1} \\
& + \beta_2 PreOverconf_{i,t-1} * PostSarbox_{i,t-1} \\
& + \beta_2 PostOverconf_{i,t-1} * PostSarbox_{i,t-1} \\
& + \sum \beta_j (Controls)_{i,t-1} + \sum (\beta_k Industry_i) \\
& + \sum (\beta_n Year_t) + \varepsilon_{i,t}
\end{aligned} \tag{4A}$$

$$\begin{aligned}
retVolatility_{i,t} = & \beta_1 PreOverconf_{i,t-1} + \beta_2 PostOverconf_{i,t-1} \\
& + \beta_3 FounderCEO_{i,t-1} + \beta_4 PostSarbox_{i,t-1} \\
& + \beta_2 PreOverconf_{i,t-1} * PostSarbox_{i,t-1} \\
& + \beta_2 PostOverconf_{i,t-1} * PostSarbox_{i,t-1} \\
& + \sum \beta_j (Controls)_{i,t-1} + \sum (\beta_k Industry_i) \\
& + \sum (\beta_n Year_t) + \varepsilon_{i,t}
\end{aligned} \tag{4B}$$

Note that we omit 2002 and 2003 as Sarbox policy transition years in (4A) and (4B). We include a dummy variable, *PostSarbox*, which is equal to one in the years 2004 and onward, and zero otherwise. We also interact *PostSarbox* with both *PreOverconf CEO* and *PostOverconf CEO* to determine whether the effect on firm stock performance (volatility) of CEO overconfidence is significantly different in the time period following Sarbox enactment.

4.4. Influence of CFO overconfidence

Firm value enhancement by overconfident CEOs depends on information production and disclosure, which might lead one to assume that CFO overconfidence could also be influential as CFOs affect the quality of information disclosures as well. However, as mentioned above, Feng et al. (2011) show that CFOs succumb to pressure from CEOs when materially manipulating accounting disclosures. Thus, it is not clear whether CFO overconfidence will marginally affect firm value when controlling for CEO overconfidence. We use the following regressions to estimate whether CFO overconfidence has a material marginal effect on firm value:

$$\begin{aligned}
retPerformance_{i,t} = & \beta_1 PreOverconf\ CEO_{i,t-1} + \beta_2 PostOverconf\ CEO_{i,t-1} \\
& + \beta_3 PreOverconf\ CFO_{i,t-1} \\
& + \beta_4 PostOverconf\ CFO_{i,t-1} \\
& + \beta_5 PreOverconf\ CEO_{i,t-1} * PreOverconf\ CFO_{i,t-1} \\
& + \beta_6 PostOverconf\ CEO_{i,t-1} * PostOverconf\ CFO_{i,t-1} \\
& + \sum \beta_j (Controls)_{i,t-1} + \sum (\beta_k Industry_i) \\
& + \sum (\beta_n Year_t) + \varepsilon_{i,t}
\end{aligned} \tag{5A}$$

$$\begin{aligned}
retVolatility_{i,t} = & \beta_1 PreOverconf\ CEO_{i,t-1} + \beta_2 PostOverconf\ CEO_{i,t-1} \\
& + \beta_3 PreOverconf\ CFO_{i,t-1} + \beta_4 PostOverconf\ CFO_{i,t-1} \\
& + \beta_5 PreOverconf\ CEO_{i,t-1} * PreOverconf\ CFO_{i,t-1} \\
& + \beta_6 PostOverconf\ CEO_{i,t-1} * PostOverconf\ CFO_{i,t-1} \\
& + \sum \beta_j (Controls)_{i,t-1} + \sum (\beta_k Industry_i) \\
& + \sum (\beta_n Year_t) + \varepsilon_{i,t}
\end{aligned} \tag{5B}$$

In (5A) and (5B), we include a dummy variable, *PreOverconf CFO*, equal to one in the year of and before a CFO is identified as having unexercised exercisable options that are at least 67% in-the-money, on average, for the second time. *PostOverconf CFO* is a dummy variable equal to 1 in the years after a CFO is identified as having unexercised exercisable options that are at least 67% in-the-money, on average, for the second time. To estimate the marginal effect of CFO overconfidence on firm value and stock volatility, we interact *PreOverconf CFO* and *PostOverconf CFO* with *PreOverconf CEO* and *PostOverconf CEO*, respectively.

4.5. Empirical results

4.5.1. Regressions for CEO overconfidence on stock return performance and volatility (H1) and (H2)

We present our results for H1 and H2 in Table 2. In H1, we are testing whether overconfident CEOs create additional firm value relative to their non-overconfident counterparts. Again, to avoid bias in our inference, we focus on the interpretation of the coefficient on *PostOverconf CEO*. However, we do find large, statistically significant positive coefficients on the *PreOverconf CEO* dummy. This finding proves the validity of our concern about endogeneity in the years prior to a CEO being

Table 2
CEO overconfidence and stock returns.

	(1) FF4 Intercept (monthly)	(2) 1-Year B-H	(3) 1-Year B-H FF 10x10	(4) Stock volatility
PreOverconf CEO	0.0130*** (9.59)	0.1977*** (8.84)	0.1954*** (9.21)	0.1446*** (3.66)
PostOverconf CEO	0.0026*** (2.88)	0.0341*** (2.70)	0.0336*** (2.74)	0.0987*** (4.17)
Log(sales)	0.0003 (0.63)	0.0204*** (2.97)	0.0223*** (3.18)	-0.1584*** (-16.97)
Log(PPE/Emp)	0.0007 (1.35)	0.0068 (1.00)	0.0071 (0.98)	0.0164* (1.71)
Stock return	-0.0007 (-0.84)	-0.0287** (-2.50)	-0.0381*** (-3.48)	0.1990*** (7.34)
Tobin's q	0.0002 (0.46)	0.0035 (0.65)	0.0019 (0.36)	-0.0049 (-0.42)
Sales growth	-0.0013 (-0.59)	-0.0488* (-1.79)	-0.0383 (-1.34)	0.3074*** (4.87)
ROA	-0.0104 (-1.31)	-0.1467 (-1.51)	-0.1168 (-1.35)	-2.3043*** (-12.45)
Book leverage	-0.0056* (-1.85)	0.0830 (0.94)	0.0461 (1.12)	0.4583*** (5.60)
Cash	0.0077* (1.90)	0.1803*** (3.38)	0.1615*** (2.88)	1.8559*** (15.60)
Log(1 + tenure)	-0.00001 (-1.07)	0.0001** (2.14)	0.0001* (1.66)	-0.0004*** (-3.98)
log(1 + delta)	-0.0004 (-0.85)	-0.0305*** (-4.45)	-0.0270*** (-3.71)	0.0218* (1.65)
log(1 + vega)	-0.0009*** (-2.63)	-0.0298*** (-5.11)	-0.0299*** (-5.11)	-0.1680*** (-13.48)
N	17,705	17,705	17,622	17,697
R ²	0.0241	0.1120	0.0486	0.4193

Notes: This table shows the results from estimating the effects of CEO confidence on stock returns and return volatility. The data sample period is from 1992 to 2010. The dependent variables in the first three specifications are the intercept from a regression of twelve monthly returns on the Fama–French–Carhart (FF4) factors (*FF4 Intercept*), the one year buy-and-hold return (*1-Year B-H*), and the one year buy-and-hold return adjusted for the firm's Fama–French 10 × 10 portfolio (*1-Year B-H FF 10x10*), respectively. The dependent variable in model (4) is daily stock return volatility measured over the following fiscal year (*Stock Volatility*). *PreOverconf CEO* (*PostOverconf CEO*) is a dummy variable equal to 1 in the year of and before (in the years after) a CEO is identified as having unexercised exercisable options that are at least 67% in the money, on average, for the second time. All independent variables are lagged. Year and industry fixed effects are controlled by dummies. Standard errors are two-way cluster adjusted by industry and year (Peterson, 2009). Test statistics are reported in parentheses. See the Appendix for detailed variable descriptions.

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

classified as overconfident. Indeed, as we expected, the coefficient on *PostOverconf CEO* is smaller in magnitude than that on *PreOverconf CEO* in each of the specifications.

More importantly, however, from the results in columns (1)–(3) in Table 2, we can infer that overconfident CEOs in the post-identification period add more value relative to their non-overconfident counterparts (the base case). This is true even when we conservatively abstract away the high endogenous returns associated with overconfidence in the pre-identification period, control for firm-level variables and lag stock returns in the model, and include industry and year fixed effects. The coefficient on *PostOverconf CEO* is positive and significant at the 99% significance level in all three measures of buy-and-hold stock return performance. Therefore, the null hypothesis of no additional value creation by overconfident CEOs (H1) can be strongly rejected. The economic significance of these coefficient values is impressive. When the buy-and-hold stock return measure is *FF4 Intercept* (model 1), the results show that an overconfident CEO adds 0.26% monthly (3.12% annually) to the equity value of a firm, compared to a non-overconfident CEO. The other two buy-and-hold stock return measures have even larger effects of overconfidence. For example, compared to non-overconfident CEOs, overconfident CEOs in the post-identification period add 3.41% (3.36%) to *1-Year B-H* (*1-Year B-H FF 10x10*).

Although a direct comparison of our results in Table 2 with the results in HLT and CHH is not possible given the contingent nature of their inquiries, it does dovetail nicely with HLT as they find that overconfident managers are better able to convert growth opportunities into realized value. More importantly, our results support the theoretical prediction that overconfidence creates additional firm value (Gervais et al., 2011; Goel and Thakor, 2008).

Similar to HLT, we regress firm stock return volatility (measured as daily stock return volatility over the next fiscal year) on the same set of controls as in the stock return performance models. The results for the model in column (4) of Table 2 provide strong evidence to reject H2 and support the theoretical prediction that overconfident CEOs engage in greater risk taking relative to non-overconfident CEOs. Economically, overconfident CEOs in the post-identification period add 0.10% to

Table 3
CEO overconfidence, founder CEOs, and stock returns.

	(1) FF4 intercept (Monthly)	(2) 1-Year B-H	(3) 1-Year B-H FF 10x10	(4) Stock volatility
PreOverconf CEO	0.0124*** (8.06)	0.1830*** (8.29)	0.1837*** (8.54)	0.1023** (2.19)
PostOverconf CEO	0.0027*** (3.17)	0.0418*** (3.06)	0.0429*** (3.01)	-0.0151 (-0.59)
Founder CEO	-0.0014 (-0.63)	0.0457* (1.69)	0.0480* (1.66)	0.0437 (1.02)
Founder × PreOverconf CEO	0.0005 (0.15)	0.0923 (1.59)	0.0983* (1.68)	0.0795 (1.00)
Founder × PostOverconf CEO	0.0039 (1.45)	0.0109 (0.35)	-0.0052 (-0.16)	0.2041*** (4.13)
Log(sales)	0.0002 (0.47)	0.0255*** (3.06)	0.0275*** (3.79)	-0.1952*** (-22.79)
Log(PPE/Emp)	0.0006 (1.32)	0.0089 (1.33)	0.0095 (1.30)	-0.0161* (-1.77)
Stock Return	-0.0012 (-1.57)	-0.0327*** (-2.48)	-0.0430*** (-3.41)	0.2132*** (6.87)
Tobin's q	-0.00003 (-0.07)	0.0044 (0.63)	0.0095 (1.43)	-0.0384** (-2.22)
Sales growth	-0.0013 (-0.63)	-0.0521* (-1.90)	-0.0484* (-1.79)	0.1645** (2.54)
ROA	-0.0016 (-0.27)	-0.1387 (-1.49)	-0.1678* (-1.74)	-2.2990*** (-12.54)
Book leverage	-0.0014 (-0.51)	0.0477 (1.14)	0.0509 (1.19)	0.5841*** (7.68)
Cash	0.0078** (2.02)	0.1673*** (3.34)	0.1580*** (2.83)	1.6171*** (11.92)
Log(1 + tenure)	-0.00001* (-1.95)	0.0001 (1.07)	0.0001 (0.82)	-0.0012*** (-10.24)
log(1 + delta)	-0.0002 (-0.60)	-0.0354*** (-4.53)	-0.0326*** (-3.95)	0.1574*** (11.35)
log(1 + vega)	-0.0008** (-2.33)	-0.0311*** (-5.32)	-0.0309*** (-5.32)	-0.0883*** (-6.96)
N	17,705	17,705	17,622	17,697
R ²	0.0181	0.1290	0.0580	0.3819

Notes: This table shows the results from estimating the effects of CEO confidence on stock returns and return volatility while controlling for founder CEO status. The data sample period is from 1992 to 2010. The dependent variables in the first three specifications are the intercept from a regression of twelve monthly returns on the Fama–French–Carhart (FF4) factors (*FF4 Intercept*), the one year buy-and-hold return (*1-Year B-H*), and the one year buy-and-hold return adjusted for the firm's Fama–French 10 × 10 portfolio (*1-Year B-H FF 10x10*), respectively. The dependent variable in specification 4 is daily stock return volatility measured over the following fiscal year (*Stock Volatility*). *PreOverconf CEO* (*PostOverconf CEO*) is a dummy variable equal to 1 in the year of and before (in the years after) a CEO is identified as having unexercised exercisable options that are at least 67% in the money, on average, for the second time. *Founder CEO* is a dummy variable equal to 1 if the current CEO is a founder of the company. All independent variables are lagged. Year and industry fixed effects are controlled by dummies. Standard errors are two-way cluster adjusted by industry and year (Peterson, 2009). Test statistics are reported in parentheses. See the Appendix for detailed variable descriptions.

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

their firms' daily stock return volatility (1.59% annualized) relative to their non-overconfident counterparts, which is also statistically significant at the 99% confidence level.⁵

We also test H1 and H2 and control for founder CEO status. The results for the first three models in columns (1)–(3) in Table 3 provide mild support for the finding that founder CEOs create firm value (Fahlenbrach, 2009). Founder CEOs' effect on firm value is statistically insignificant using *FF4 Intercept* as a performance measure in model (1) and they also do not exhibit any discernible risk taking (model (4)). However, based on *1-Year B-H* and *1-Year B-H FF 10x10*, we find that founder CEOs add value to the firm, and the coefficients are statistically significant at the 90% level. Specifically, in columns (2) and (3), founder CEOs add 4.57% and 4.80% to stock return performance relative to the base case of a non-founding, non-overconfident CEO, respectively. These magnitudes relate well to the 8.30% annual abnormal performance found in Fahlenbrach (2009).

Our findings are mild evidence that founder CEOs create additional value for the firm, independent of CEO overconfidence. However, inclusion of founder status in the regression has no material impact on the magnitude of the positive effect on firm value of CEO overconfidence in the post-identification period. The interaction of *PostOverconf CEO* with *Founder CEO*

⁵ Following Hirshleifer et al. (2012), we include log of one plus CEO vega and log of one plus CEO delta as compensation sensitivities in our regressions. However, we also ran our tests when scaling vega and delta by market capitalization and our results remained robust.

carries no meaningful explanatory power for firm value added. However, inclusion of founder status in model (4) does fundamentally change the relation between CEO overconfidence and risk taking. Overconfident CEOs in the post-identification period no longer engage in higher risk taking, nor do the founder CEOs. Instead, the higher risk-taking result is driven by founder CEOs who also are overconfident in the post-identification period. The coefficient for the interaction of *PostOverconf CEO* with *Founder CEO* is 0.20%, which is significant at the 99% confidence level. This suggests firms with founder CEOs who are overconfident in the post-identification period experience annualized stock return volatility that is higher by 3.17%.

4.5.2. CEO overconfidence in innovative and non-innovative industries (H3) and (H4)

Next, we test H3 and H4 by analyzing whether there are systematic differences in overconfidence adding to firm stock return performance and volatility across innovative and non-innovative industries. We first run the same models as for Table 2 for firms in innovative and non-innovative industries separately. These results are presented in Table 4, where columns (1)–(4) pertain to innovative industries, while columns (5)–(8) are for non-innovative industries.

Our results strongly support that CEO overconfidence leads to value creation for firms in innovative industries, which in essence strengthens the arguments of HLT and Galasso and Simcoe (2011). The coefficients on *PostOverconf CEO* are positive and economically significant (all are statistically significant at or above the 95% confidence level) in columns (1)–(3), which attest to value creation in innovative industries. Interestingly, our results for non-innovative industries are not radically different. The coefficients on *PostOverconf CEO* in columns (5)–(7) for the non-innovative industry subsample are also

Table 4

Overconfidence and stock returns: innovative vs. non-innovative industries.

	Innovative industries				Non-innovative industries			
	(1) FF4 intercept (monthly)	(2) 1-Year B-H	(3) 1-Year B-H FF 10x10	(4) Stock volatility	(5) FF4 intercept (monthly)	(6) 1-Year B-H	(7) 1-Year B-H FF 10x10	(8) Stock volatility
PreOverconf CEO	0.0132*** (6.39)	0.2216*** (6.85)	0.2203*** (7.18)	0.1274** (2.02)	0.0104*** (5.61)	0.1425*** (6.48)	0.1485*** (6.27)	0.1187*** (3.25)
PostOverconf CEO	0.0035*** (3.12)	0.0446** (2.38)	0.0414** (2.13)	0.0585* (1.90)	0.0023* (1.81)	0.0301** (2.09)	0.0305** (1.97)	0.0929*** (3.27)
Founder CEO	0.0008 (0.44)	0.0618*** (2.59)	0.0535** (2.32)	0.2220*** (6.10)	0.0001 (0.04)	0.0604* (2.13)	0.0622** (2.09)	0.2790*** (5.52)
Log(sales)	0.0001 (0.08)	0.0362*** (3.44)	0.0383*** (3.66)	-0.1240*** (-8.37)	0.0012** (2.38)	0.0254** (2.42)	0.0296*** (2.80)	-0.1744*** (-13.57)
Log(PPE/Emp)	0.0013** (2.24)	0.0283** (2.56)	0.0256** (2.19)	0.0895*** (5.10)	-0.0010 (-1.44)	-0.0239* (-1.74)	-0.0228 (-1.61)	-0.0409*** (-2.56)
Stock Return	-0.0016 (-1.51)	-0.0430** (-2.55)	-0.0494*** (-3.06)	0.2233*** (5.75)	-0.0001 (-0.13)	-0.0178 (-0.99)	-0.0371** (-1.97)	0.1921*** (6.99)
Tobin's q	-0.0004 (-0.90)	0.0067 (0.76)	0.0099 (1.27)	0.0077 (0.48)	0.0002 (0.17)	-0.0045 (-0.38)	0.0053 (0.42)	-0.0157 (-1.03)
Sales growth	-0.0019 (-0.76)	-0.0721** (-2.19)	-0.0781** (-2.33)	0.1029 (1.37)	-0.0023 (-0.60)	-0.0329 (-0.80)	-0.0212 (-0.54)	0.2862*** (3.68)
ROA	0.0022 (0.35)	-0.1024 (-0.81)	-0.1177 (-0.84)	-2.5174*** (-9.74)	-0.0111 (-0.98)	-0.2203 (-1.36)	-0.2659* (-1.65)	-1.9452*** (-8.52)
Book leverage	-0.0001 (-0.02)	0.0939 (1.56)	0.0953 (1.54)	0.4601*** (4.41)	-0.0029 (-0.85)	-0.0242 (-0.52)	0.0296 (0.60)	0.8101*** (8.97)
Cash	0.0037 (0.78)	0.1486** (2.42)	0.1326** (1.98)	1.5050*** (9.99)	0.0098 (1.45)	0.0953 (1.26)	0.0947 (1.13)	1.1350*** (6.58)
Log(1 + tenure)	-0.00001* (-1.85)	0.0001 (1.25)	0.0001 (0.92)	-0.0005*** (-3.57)	0.000002 (0.27)	0.0001* (1.65)	0.0001* (1.70)	-0.0003** (-2.32)
log(1 + delta)	-0.0002 (-0.22)	-0.0468*** (-3.86)	-0.0429*** (-3.46)	0.0032 (0.17)	-0.0009 (-1.62)	-0.0262*** (-2.70)	-0.0246** (-2.33)	-0.0129 (-0.96)
log(1 + vega)	-0.0010* (-1.93)	-0.0426*** (-4.64)	-0.0422*** (-4.74)	-0.1955*** (-9.03)	-0.0011*** (-2.61)	-0.0293*** (-3.63)	-0.0310*** (-3.72)	-0.0988*** (-8.24)
N	10,477	10,477	10,425	10,474	7228	7228	7197	7223
R ²	0.0186	0.1466	0.0693	0.4125	0.0270	0.1160	0.0543	0.4826

Notes: This table shows the results from estimating the effects of CEO confidence on stock returns and return volatility over two different subsamples based on whether a firm is in an innovative industry as designated by Hirshleifer et al. (2012). The data sample period is from 1992 to 2010. The dependent variables in each of the first three specifications for each subsample are the intercept from a regression of twelve monthly returns on the Fama–French–Carhart (FF4) factors (*FF4 Intercept*), the one year buy-and-hold return (*1-Year B-H*), and the one year buy-and-hold return adjusted for the firm's Fama–French 10 × 10 portfolio (*1-Year B-H FF 10x10*), respectively. The dependent variable in specifications 4 and 8 is daily stock return volatility measured over the following fiscal year (*Stock Volatility*). *PreOverconf CEO* (*PostOverconf CEO*) is a dummy variable equal to 1 in the year of and before (in the years after) a CEO is identified as having unexercised exercisable options that are at least 67% in the money, on average, for the second time. *Founder CEO* is a dummy variable equal to 1 if the current CEO is a founder of the company. All independent variables are lagged. Year and industry fixed effects are controlled by dummies. Standard errors are two-way cluster adjusted by industry and year (Peterson, 2009). Test statistics are reported in parentheses. See the Appendix for detailed variable explanations.

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

positive and are only slightly lower in magnitude than those obtained for the innovative industry subsample. Overall, the results in Table 4 indicate strong value creation by overconfident CEOs in innovative as well as non-innovative industries.

Risk-taking results (columns (4) and (8) in Table 4) across the two industry types also run parallel to the above value creation results. Overconfident CEOs in the post-identification period engage in significant risk taking across both industry groups with 0.06% (0.09%) daily higher standard deviation relative to their non-overconfident counterparts in innovative (non-innovative) industries, with significance at the 90% (99%) confidence level. This suggests that the higher level of risk taking by overconfident CEOs in the post-identification period translates into greater value creation across the industry groups, relative to non-overconfident CEOs. The results for founder CEOs once again run a close parallel, although they are slightly weaker for value creation. While founder CEOs do not appear to add additional firm value according to the results for *FF4 Intercept* (columns (1) and (5)) with near zero coefficients, they do appear to add value by the other two return measures (columns (2), (3), (6) and (7)) at the 90% confidence level or above. We find that founder CEOs also take more risk (columns (4) and (8)), independent of CEO overconfidence, adding 0.22% and 0.28% of daily stock return volatility in innovative and non-innovative industries, respectively, with both coefficients significant at the 99% confidence level.

These value creation results complement known results in a conclusive way. While HLT and Galasso and Simcoe (2011) show that CEO overconfidence leads to greater innovation and better exploitation of growth opportunities, we find that it also benefits shareholders in a significant way through superior stock return performance. Further, similar to HLT, we find that overconfident CEO-led firms exhibit significantly higher return volatility. Nevertheless, our results differ from those in HLT in an important way. While HLT find that innovative success and successful conversion of growth opportunities is concentrated in innovative industries, we find that CEO overconfidence helps add value to the firm in innovative and non-innovative industries. Indeed, it is likely that overconfident CEOs are not merely superior at delivering on the typical measures of innovation (patent, citations, etc.), they are also better at cost-cutting, effective marketing, financing, and many other aspects of managerial effort that create value for the firm. Of course, innovation is useful in every sphere of managerial activity (not just those involving patents and growth opportunities), which perhaps allows an overconfident CEO to create value in non-innovative industries. It is also important to note that Fahlenbrach (2009) finds abnormal performance for founder CEO-led firms even when eliminating technology firms from the analysis. Once again, our results run parallel to those in Fahlenbrach (2009) in an important and intuitive manner.

We now formally test whether there is a difference in value and risk across industry groups based on CEO overconfidence by introducing the interactions between *PreOverconf CEO* and *PostOverconf CEO* with *Innov* into the model used to generate the results in Table 4. The results from this model are presented in Table 5. The coefficient on the indicator variable capturing CEO overconfidence in innovative industries for the post-identification period (*PostOverconf CEO* × *Innov*) lacks significance at conventional levels for the three buy-and-hold stock return models, thus supporting the null hypothesis of no difference in value creation due to CEO overconfidence across the two industry types (H3). Exactly the same is true for the volatility model where the coefficient on *PostOverconf CEO* interacted with *Innov* is again statistically insignificant. Thus, the hypotheses that overconfident CEOs engage in risk taking similarly across innovative and non-innovative industries cannot be rejected (H4).⁶

4.5.3. Calendar time portfolios

We also calculate monthly calendar-time returns (CTR), an alternative stock return performance definition, of portfolios that are formed based on whether a firm has a non-overconfident CEO or an overconfident CEO in the pre- or post-identification period to investigate the strength and pervasiveness of our results. Table 6 presents the results of regressions where the monthly returns of these portfolios are regressed on the Fama–French–Carhart (FF4) factors and *PreOverconf CEO* and *PostOverconf CEO*.

This alternative measure of stock return performance supports our results from Table 2. For the full sample (column (1)), the portfolio consisting of firms led by overconfident CEOs in the post-identification period earns a 0.35% higher (4.20% annualized) monthly return than the portfolio consisting of firms led by non-overconfident managers, with significance at the 95% confidence level. Reassuringly, the coefficient on *PostOverconf CEO* is close to the coefficient (0.26%) on *PostOverconf CEO* obtained through the *FF4 Intercept* regression with our panel of CEO-firm-years (Table 2).

We also check the robustness of our industry-group results using calendar-time portfolio returns. The regressions of calendar-time portfolio returns on the FF4 factors and *PreOverconf CEO* and *PostOverconf CEO* for innovative and non-innovative industries are respectively presented in columns (2) and (3) in Table 6. These results are quantitatively and qualitatively similar to those presented for the full sample (column (1)). For innovative industries (column (2)), the CTR regression yields a coefficient on *PostOverconf CEO* of 0.43%, which is also significant at the 95% confidence level. For non-innovative industries, the same coefficient is only a bit lower at 0.37% (column (3)), and it is significant at the 90% confidence level.

⁶ We test the robustness of the effect of CEO overconfidence on firm value in innovative industries by classifying firms into high-tech and non-high-tech industries based on classifications by Loughran and Ritter (2004). The results confirm our findings using the HLT classification and are available upon request.

Table 5
Incremental value creation by overconfident CEOs in innovative industries.

	(1) FF4 intercept (monthly)	(2) 1-Year B-H	(3) 1-Year B-H FF 10x10	(4) Stock volatility
PreOverconf CEO	0.0104*** (5.54)	0.1551*** (6.39)	0.1590*** (6.23)	0.0994*** (2.63)
PostOverconf CEO	0.0028** (2.25)	0.0481*** (3.01)	0.0504*** (3.07)	0.0993*** (3.38)
Founder CEO	0.0006 (0.43)	0.0649*** (3.50)	0.0592*** (3.24)	0.2519*** (8.75)
Innov	-0.0027 (-0.40)	0.0055 (1.73)	-0.0188 (-0.18)	0.2422 (1.33)
PreOverconf CEO × Innov	0.0031 (1.10)	0.0609 (1.55)	0.0569 (1.47)	0.0450 (0.64)
PostOverconf CEO × Innov	0.0005 (0.32)	-0.0146 (-0.65)	-0.0207 (-0.92)	-0.0433 (-1.17)
Log(sales)	0.0004 (0.87)	0.0301*** (4.02)	0.0330*** (4.43)	-0.1416*** (-13.89)
Log(PPE/Emp)	0.0006 (1.19)	0.0100 (1.16)	0.0083 (0.93)	0.0465*** (3.46)
Stock Return	-0.0011 (-1.42)	-0.0351*** (-2.66)	-0.0456*** (-3.60)	0.2109*** (7.27)
Tobin's q	-0.0002 (-0.46)	0.0034 (0.48)	0.0084 (1.27)	0.0004 (0.03)
Sales growth	-0.0017 (-0.81)	-0.0567** (-2.10)	-0.0532** (-2.00)	0.1678*** (2.89)
ROA	-0.0027 (-0.46)	-0.1471 (-1.50)	-0.1747* (-1.71)	-2.2562*** (-11.99)
Book leverage	-0.0011 (-0.40)	0.0738* (1.72)	0.0756* (1.72)	0.5989*** (7.79)
Cash	0.0061 (1.63)	0.1333*** (2.76)	0.1247** (2.36)	1.4487*** (12.25)
Log(1 + tenure)	-0.000006 (-1.41)	0.0001* (1.76)	0.0001 (1.55)	-0.0005*** (-4.79)
log(1 + delta)	-0.0004 (-0.86)	-0.0376*** (-4.70)	-0.0345*** (-4.16)	-0.0017 (-0.14)
log(1 + vega)	-0.0010*** (-2.87)	-0.0366*** (-5.77)	-0.0370*** (-5.93)	-0.1568*** (-11.52)
N	17,705	17,705	17,622	17,697
R ²	0.0187	0.1306	0.0600	0.4324

Notes: This table shows the results from estimating the effects of CEO confidence and industry innovation designation on stock returns and return volatility. The data sample period is from 1992 to 2010. The dependent variables in the first three specifications are the intercept from a regression of twelve monthly returns on the Fama–French–Carhart (FF4) factors (*FF4 Intercept*), the one year buy-and-hold return (*1-Year B-H*), and the one year buy-and-hold return adjusted for the firm's Fama–French 10 × 10 portfolio (*1-Year B-H FF 10x10*), respectively. The dependent variable in specification 4 is daily stock return volatility measured over the following fiscal year (*Stock Volatility*). *PreOverconf CEO* (*PostOverconf CEO*) is a dummy variable equal to 1 in the year of and before (in the years after) a CEO is identified as having unexercised exercisable options that are at least 67% in the money, on average, for the second time. *Innov* is a dummy variable equal to 1 if the CEO–firm observation is in an innovative industry as designated by Hirshleifer et al. (2012). *Founder CEO* is a dummy variable equal to 1 if the current CEO is a founder of the company. All independent variables are lagged. Year and industry fixed effects are controlled by dummies. Standard errors are two-way cluster adjusted by industry and year (Peterson, 2009). Test statistics are reported in parentheses. See the Appendix for detailed variable explanations.

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

4.5.4. Overconfidence and Sarbanes–Oxley Act (H5) (H6)

First, we test H5, a specific empirical prediction of corollary 2 in Goel and Thakor (2008), to give us better insight into regulatory penalty requirements in Sarbox and their effect on the likelihood of CEO overconfidence through a two-sample *t*-test of proportions with unequal variances. In untabulated results, we find that fully 43% of the pre-Sarbox CEO hires were overconfident while only 30% of the post-Sarbox CEO hires were overconfident. The null hypothesis of equal proportions (H5) is strongly rejected at the 99% confidence level. This result strongly supports the prediction of Goel and Thakor that the likelihood of CEO overconfidence declines with the possibility of regulatory penalties.

Next, we run our regressions of the three stock return performance measures and stock return volatility similar to prior tables with an additional indicator variable named *PostSarbox*, which is set to one for the years 2004–2010. We also interact this variable with *Pre-* and *PostOverconf CEO* to study the marginal effect of *PostSarbox* on value creation by overconfident CEOs. Table 7 presents the results of these regressions to test the predictions (H6) of Goel and Thakor (2008).

Table 7 shows that, for all three return performance measures, the coefficient on the interaction between *PostSarbox* and *PostOverconf CEO* is negative and economically significant. The coefficient is -5.11% for *1-Year B-H* and -5.86% for *1-Year B-H*

Table 6
Overconfidence and calendar-time stock return performance.

	(1) Full sample	(2) Innovative	(3) Non-innovative
PreOverconf CEO	0.0156*** (9.66)	0.0162*** (7.89)	0.0151*** (7.42)
PostOverconf CEO	0.0035** (2.12)	0.0043** (2.11)	0.0037* (1.89)
MKTRF	1.0629*** (64.96)	1.1388*** (55.04)	0.9456*** (46.11)
SMB	0.5932*** (28.24)	0.6258*** (23.56)	0.5362*** (20.37)
HML	0.2663*** (12.06)	0.1254*** (4.49)	0.4740*** (17.13)
UMD	-0.1802*** (-13.54)	-0.1842*** (-10.94)	-0.1731*** (-10.38)
Intercept	0.0004 (0.35)	0.0007 (0.50)	-0.00003 (-0.02)
N	720	719	719
R ²	0.9146	0.8871	0.8430

Notes: This table shows the results from estimating the effects of CEO confidence on calendar-time stock returns for the aggregate sample and the innovative and non-innovative subsamples. The monthly returns are equally weighted within portfolio with firms being annually assigned to one of three portfolios based on CEO confidence. Innovative industries are designated by following Hirshleifer et al. (2012). The data sample period is from 1992 to 2010. The dependent variable in each of the specifications is monthly returns adjusting for the Fama–French–Carhart (FF4) factors. *MKTRF* is the monthly market risk premium over risk free rate; *SMB* is the difference in monthly returns between small-cap and big-cap portfolios; *HML* is the difference in monthly returns between growth and value portfolios; *UMD* is the momentum factor. *PreOverconf CEO* (*PostOverconf CEO*) is a dummy variable equal to 1 in the year of and before (in the years after) a CEO is identified as having unexercised exercisable options that are at least 67% in the money, on average, for the second time. Test statistics are reported in parentheses.

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

FF 10x10 and both are significant at the 95% confidence level. For *FF4 Intercept*, the coefficient is -0.31% for monthly returns (-3.72% annualized) but the *t*-statistic is 1.59, which is significant at just above the 10% confidence level. Nevertheless, it is evident that overconfident CEOs add less value in the post-Sarbox period. Also, in the volatility regression, the coefficient on the interaction between *PostSarbox* and *PostOverconf CEO* is -0.17%, which is significant at the 99% confidence level. This suggests annualized stock return volatility of firms with an overconfident CEO in the post-identification period post-Sarbox is lower by 2.70% compared to overconfident CEOs in the post-identification period pre-Sarbox.

Overall, these results here provide strong evidence that overconfident CEOs are less frequent, take less risk, and add less value to the firm in the post-Sarbox period. We interpret these results as empirical support for Goel and Thakor's (2008) predictions in Corollary 2 and as strong evidence to reject H5 and H6. Thus, depending on the study period, future empirical studies of the impact of CEO overconfidence on firm value, or more broadly firm policy, should consider the potential effect of the enactment of Sarbox.

4.5.5. CFO overconfidence and its marginal impact on value (H7) (H8)

While our results strongly suggest that CEO overconfidence adds value, CFO personality traits matter as well. Therefore, one must entertain a clear possibility that CFO overconfidence may also affect value creation. However, one must also note that Feng et al. (2011) produce strong evidence to the contrary and find that CEOs exert pressure on CFOs, in which case only CEO overconfidence should be material to value creation. To test whether CFO overconfidence also affects firm stock return performance and volatility, we now add two CFO overconfidence indicator variables (*PreOverconf CFO* and *PostOverconf CFO*) to our analysis in Table 2 and present the results in Table 8.

One issue to bear in mind here is that ExecuComp data are far sparser for CFOs than CEOs; therefore, our number of observations drops from approximately 17,000 (depending on the test conducted in Table 2) to approximately 5000 in Table 8. First, in Panel A of Table 8, we present descriptive statistics on the association between CEO and CFO overconfidence. Of 2335 unique CEO–CFO pairs (not firm years) in our data, we find that it is far more likely for a firm to have both a CEO and a CFO with a similar confidence trait. For instance, in 613 firms, both are overconfident while in another 929 firms they are both non-overconfident, bringing the similar confidence trait firm count to 1542 (66% of the total number of pairs). In only 291 firms is an overconfident CEO matched with a non-overconfident CFO, while in the remaining 502 firms a non-overconfident CEO is matched with an overconfident CFO. Of course, the high degree of CEO and CFO coincidence may make it hard to disentangle the two overconfidence effects.

We examine whether CFO overconfidence adds value and control for CEO overconfidence. The results in Panel B of Table 8 show that overconfident CEOs in the post-identification period generally add significant value to a firm despite the drastic loss in sample size. However, overconfident CFOs in the post-identification period do not marginally add value to the firm. In fact, the coefficients on *PostOverconf CFO* in the three return performance regressions are negative and significant at the

Table 7
Overconfidence, stock returns, and Sarbanes–Oxley.

	(1) FF4 intercept (monthly)	(2) 1-Year B-H	(3) 1-Year B-H FF 10x10	(4) Stock volatility
PreOverconf CEO	0.0120*** (4.95)	0.1894*** (7.86)	0.1940*** (7.97)	0.2570*** (4.44)
PostOverconf CEO	0.0051*** (3.12)	0.0676*** (3.72)	0.0683*** (3.73)	0.1547*** (5.73)
Founder CEO	0.0019 (1.24)	0.0779*** (3.89)	0.0762*** (3.70)	0.1398*** (4.26)
PostSarbox	-0.0109** (-2.36)	-0.0432 (-0.92)	0.0046 (0.13)	0.6879*** (4.25)
PreOverconf CEO × PostSarbox	-0.0008 (-0.25)	0.0137 (0.34)	0.0090 (0.23)	-0.2351*** (-3.20)
PostOverconf CEO × PostSarbox	-0.0031 (-1.59)	-0.0511** (-2.11)	-0.0586** (-2.41)	-0.1745*** (-5.05)
Log(sales)	0.0005 (0.79)	0.0340*** (3.79)	0.0335*** (3.71)	-0.1734*** (-15.79)
Log(PPE/Emp)	0.0005 (0.87)	0.0042 (0.44)	0.0020 (0.21)	0.0098 (0.67)
Stock Return	-0.0006 (-0.78)	-0.0249** (-1.99)	-0.0330*** (-2.74)	0.1838*** (8.51)
Tobin's q	-0.0007* (-1.78)	-0.0003 (-0.05)	0.0037 (0.55)	0.0096 (0.82)
Sales growth	-0.0039* (-1.70)	-0.0490* (0.55)	-0.0498* (-1.92)	0.2078*** (4.36)
ROA	-0.0042 (-0.76)	-0.0941 (-0.95)	-0.1361 (-1.39)	-1.7690*** (-9.73)
Book leverage	-0.0023 (-0.68)	0.0472 (1.09)	0.0518 (1.14)	0.7340*** (9.03)
Cash	0.0048 (1.06)	0.0529 (1.03)	0.0442 (0.86)	0.5095*** (5.32)
Log(1 + tenure)	-0.000002 (-0.34)	0.0001** (2.35)	0.0001** (2.27)	-0.0005*** (4.91)
log(1 + delta)	-0.0011* (-1.99)	-0.0483*** (5.38)	-0.0471*** (5.42)	-0.0001 (-0.01)
log(1 + vega)	-0.0012*** (-2.78)	-0.0353*** (-5.28)	-0.0367*** (-4.47)	-0.1494*** (-11.71)
N	15,404	15,404	15,323	15,410
R ²	0.0194	0.1218	0.0604	0.4571

Notes: This table shows the results from estimating the effects of CEO confidence on stock returns and return volatility while controlling for the implementation of Sarbanes–Oxley. Transition years (2002 and 2003) are omitted from the analysis and *PostSarbox* is a dummy variable equal to 1 if the year is after 2003. The dependent variables in the first three specifications are the intercept from a regression of 12 monthly returns on the Fama–French–Carhart (FF4) factors (*FF4 Intercept*), the one year buy-and-hold return (*1-Year B-H*), and the one year buy-and-hold return adjusted for the firm's Fama–French 10 × 10 portfolio (*1-Year B-H FF 10x10*), respectively. The dependent variable in specification 4 is daily stock return volatility measured over the following fiscal year (*Stock Volatility*). *PreOverconf CEO* (*PostOverconf CEO*) is a dummy variable equal to 1 in the year of and before (in the years after) a CEO is identified as having unexercised exercisable options that are at least 67% in the money, on average, for the second time. *Founder CEO* is a dummy variable equal to 1 if the current CEO is a founder of the company. All independent variables are lagged. Year and industry fixed effects are controlled by dummies. Standard errors are two-way cluster adjusted by industry and year (Peterson, 2009). Test statistics are reported in parentheses. See the Appendix for detailed variable explanations.

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

conventional 95% confidence level, barring the case of *FF4 Intercept* where the *t*-statistic is significant at the 90% confidence level. This indicates that overconfident CFOs inhibit value creation when they are paired with a non-overconfident CEO. Interestingly, the interaction term for CEO and CFO overconfidence in the post-identification period (*PostOverconf CEO × PostOverconf CFO*) produces a positive and significant effect for value creation. Similarly, with volatility as the dependent variable (column (4)), an overconfident CFO in the post-identification period produces a negative effect on volatility, which is significant at the 95% confidence level. Likewise, the interaction term for CEO and CFO overconfidence in the post-identification period has a positive and significant effect on volatility.

Overall, the following story emerges. An overconfident CFO paired with a non-overconfident CEO inhibits firm value creation and risk taking perhaps because she prevails over the CEO and provides strong disclosures. However, with both the CEO and the CFO being overconfident, risk taking and value creation increase. Above all, the key result stands that an overconfident CEO unconditionally adds value to the firm, irrespective of CFO overconfidence. We must refrain from making a strong inference in view of a sharply reduced sample size. Further, there is a high degree of correlation between CEO and CFO overconfidence, which makes it more challenging to differentiate the two effects.

Table 8

CEO and CFO overconfidence and stock returns.

Panel A: Association of CEO and CFO overconfidence				
	Overconfident CFO		Non-overconfident CFO	Total
Overconfident CEO	613		291	904
Non-overconfident CEO	502		929	1431
Total	1115		1220	2335

Panel B: CEO and CFO overconfidence and stock returns				
	(1) FF4 intercept (monthly)	(2) 1-Year B-H	(3) 1-Year B-H FF 10x10	(4) Stock volatility
PreOverconf CEO	0.0132*** (5.61)	0.2376*** (3.38)	0.2440*** (7.14)	0.1063* (1.71)
PreOverconf CFO	0.0050** (2.11)	0.1459* (1.80)	0.1631*** (4.61)	0.0272 (0.42)
PreOverconf CEO × PreOverconf CFO	0.0064** (1.97)	0.0648 (1.43)	0.0794* (1.81)	-0.1302 (-1.59)
PostOverconf CEO	0.0038** (2.28)	0.0453* (1.72)	0.0393** (2.26)	0.1115** (2.43)
PostOverconf CFO	-0.0046* (-1.73)	-0.0971** (-2.15)	-0.0808** (-2.58)	-0.1689** (-2.36)
PostOverconf CEO × PostOverconf CFO	0.0076*** (2.91)	0.1138** (1.97)	0.0737* (1.79)	0.1262* (1.78)
Log(sales)	-0.0004 (-0.31)	0.0597*** (3.01)	0.0215*** (2.70)	-0.0865*** (-5.19)
Log(PPE/Emp)	0.0007 (1.19)	0.0033 (0.32)	0.0102 (1.42)	-0.0006 (-0.05)
Stock Return	-0.0019** (-2.23)	-0.0458** (-2.11)	-0.0334** (-2.44)	0.2902*** (8.78)
Tobin's q	-0.0024*** (-2.86)	0.0140 (0.99)	-0.0061 (-0.65)	-0.0375** (-2.27)
Sales growth	-0.0031 (-0.81)	-0.0673 (-1.47)	-0.0664 (-1.65)	0.0646 (1.09)
ROA	0.0059 (0.75)	-0.2811 (-1.51)	-0.1225 (-1.23)	-1.7753*** (-10.79)
Book leverage	-0.0018 (-0.30)	0.1427* (1.81)	0.1016 (0.25)	0.9375*** (9.20)
Cash	-0.0067 (-0.93)	0.1302* (1.99)	0.0480 (0.76)	0.7524*** (5.56)
Log(1 + tenure)	0.00001 (0.41)	0.0004*** (3.29)	0.0003*** (2.64)	0.0004* (1.85)
log(1 + delta)	-0.0006 (-0.53)	-0.0939*** (-3.68)	-0.0407*** (-3.70)	-0.0737*** (-3.17)
log(1 + vega)	-0.0003 (-0.30)	-0.0336*** (-2.88)	-0.0119** (-2.04)	-0.2257*** (-10.43)
N	5018	5091	5086	5091
R ²	0.0522	0.1771	0.1527	0.3925

Notes: This table introduces CFO confidence to our analysis of CEO confidence. Panel A reports the incidence of overconfident and non-overconfident CEO and CFO pairs. Panel B reports the results from estimating the effects of CEO confidence on stock returns and return volatility while controlling for CFO confidence. The data sample period is from 1992 to 2010. The dependent variables in the first three specifications of Panel B are the intercept from a regression of twelve monthly returns on the Fama–French–Carhart (FF4) factors (*FF4 Intercept*), the one year buy-and-hold return (*1-Year B-H*), and the one year buy-and-hold return adjusted for the firm's Fama–French 10 × 10 portfolio (*1-Year B-H FF 10x10*), respectively. The dependent variable in model (4) in 4 of Panel B is daily stock return volatility measured over the following fiscal year (*Stock Volatility*). *PreOverconf CEO* (*PreOverconf CFO*) is a dummy variable equal to 1 in the year of and before a CEO (CFO) is identified as having unexercised exercisable options that are at least 67% in the money, on average, for the second time. *PostOverconf CEO* (*PostOverconf CFO*) is a dummy variable equal to 1 in the years after a CEO (CFO) is identified as having unexercised exercisable options that are at least 67% in the money, on average, for the second time. Year and industry fixed effects are controlled by dummies. Standard errors are two-way cluster adjusted by industry and year (Peterson, 2009). Test statistics are reported in parentheses. See the Appendix for detailed variable descriptions.

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

5. Robustness tests

We use the traditional option moneyness-based measure of CEO overconfidence, pioneered by [Malmendier and Tate \(2005, 2008\)](#), which, as discussed above, has commonly been used in the related prior literature.⁷ Casual intuition suggests that this measure may also be related to inside information. The premise is that a CEO in possession of positive inside information will be less likely to exercise options in a high moneyness options portfolio, which would also likely brand her as overconfident. Subsequently, the firm is likely to experience positive stock return performance making it unclear whether this superior return performance is attributable to private information or CEO overconfidence. Of course, [Malmendier and Tate \(2005\)](#) produce strong evidence to refute this premise by showing that the CEO exercise behavior is highly correlated with past exercise behavior but is unrelated to the undervaluation of the firm, thus implying a CEO personal fixed effect. They also show that the CEOs who hold a high moneyness options portfolio only outperform the market the following year 45.86% of the time, which flies in the face of an inside information-based argument.

Nevertheless, as we crucially analyze future abnormal returns, we revisit this issue to test whether our results are moneyness driven. In this test, we simply use the vested option portfolio moneyness as a continuous variable. Naturally, based on the inside information explanation, future abnormal returns should be related to the moneyness of the vested options portfolio – the variable on which our overconfidence identification is based. One can perhaps also think of this moneyness variable as a continuous time-varying measure of CEO confidence, while our measure is a time-invariant measure (where once classified as overconfident, the CEO is overconfident for the rest of the tenure).

We regress our three return performance measures and stock volatility on this continuous measure of moneyness, along with the other independent variables from [Table 2](#) and present the results in [Table 9](#). In Panel A, the regressions in columns (1)–(3) hint at a weak but positive relationship between firm value generation and moneyness. For the case of the *FF4 Intercept*, moneyness is positively correlated with future stock return performance and the effect is significant at 95% confidence level. However, the other two stock return performance regressions produce insignificant coefficients on moneyness. Stock volatility, though, is strongly related to moneyness at the 99% confidence level, with a coefficient of 0.04%, which is much lower than produced in [Table 2](#) with *PostOverconf CEO*.

Next, we include *Pre-* and *PostOverconf CEO* in the regression and present the results in Panel A in columns (5)–(8). Once our overconfidence variables are included, there is no evidence that moneyness is related to the three return performance measures and the coefficient on *PostOverconf CEO* is positive and significant for all three return measures.⁸ Therefore, we conclude that the traditional, time-invariant definition of overconfidence is not a mere artifact of moneyness and is more like a CEO fixed effect. However, it is interesting to note that moneyness does provide some explanatory power for the volatility despite the inclusion of the overconfidence variables, although it is small in comparison to the coefficient on *PostOverconf CEO*.

While our results are robust to the inclusion of moneyness, we examine an alternative definition for inside information in the form of the change in moneyness over the previous period, with the intuition that changes may be more informative than the absolute levels for moneyness. Panel B of [Table 9](#) presents the regression results when including *Change in Moneyness*. The results in columns (1)–(4) indicate that changes in moneyness are unrelated to the three stock return performance measures while it is significantly negatively related to stock return volatility (opposite of what was observed for levels). In columns (5)–(8), once we include our overconfidence measures, *PostOverconf CEO* carries coefficients that are significantly positively related and not qualitatively different from [Table 2](#).

Overall, the results in [Table 9](#) provide strong evidence that our main findings are not driven by an inside information-based story related to moneyness. Nevertheless, we try an alternative test of robustness to see whether an inside information-based story may yet provide explanatory power for our main result. [Zhang \(2006\)](#) shows that short-term stock price continuation is due to information uncertainty. Of course, greater uncertainty would generally be related to greater information asymmetry leading to inside information. We employ as controls four proxies of information uncertainty used in [Zhang \(2006\)](#): firm age in years (*Firm Age*), the firm's CPI-adjusted market capitalization (*CPIMC*), standard deviation of cash flow from operations over the previous five years (*CVOL*), and the standard deviation of weekly market excess returns over the previous one year (*SIGMA*). Other variables and controls remain the same as in [Table 2](#) and the results of these robustness tests are presented in [Table 10](#).

Despite the inclusion of the asymmetric information control variables, our results remain unchanged. The results in [Table 10](#) show that all three stock return performance measures and volatility are related to CEO overconfidence in a significant and positive manner. The magnitudes of the coefficients are also very similar to what is observed in [Table 2](#). This is despite the fact that all four information asymmetry variables are significantly related to volatility at the 99% confidence level (consistent with [Zhang, 2006](#)). For instance, older firms and higher deflated market value firms, arguably the firms with less information asymmetry, have lower future stock return volatility, while firms with high idiosyncratic risk and cash flow volatility tend

⁷ The other alternative for the overconfidence is a survey-based method that has been employed in only a handful of studies (e.g., [Ben-David et al., 2007](#); [Graham et al., 2013](#)). Despite being subject to the usual caveats of survey-based approaches, the results of these studies strongly corroborate those found with the option holding-based measure of CEO overconfidence.

⁸ This evidence is in line with prior empirical studies that find option exercises are not predictive of future returns (see, e.g., [Carpenter and Remmers, 2001](#)).

Table 9
Overconfidence, moneyness, and stock returns.

Panel A: CEO overconfidence, level of moneyness, and stock returns								
	(1) FF4 intercept (monthly)	(2) 1-Year B-H	(3) 1-Year B-H FF 10x10	(4) Stock volatility	(5) FF4 intercept (monthly)	(6) 1-Year B-H	(7) 1-Year B-H FF 10x10	(8) Stock volatility
PreOverconf CEO					0.0131*** (9.24)	0.2097*** (9.13)	0.2072*** (9.32)	0.1195*** (2.93)
PostOverconf CEO					0.0022** (2.37)	0.0360*** (2.79)	0.0351*** (2.61)	0.0729*** (2.88)
Moneyness	0.0009** (2.13)	0.0063 (1.02)	0.0065 (1.08)	0.0368*** (4.10)	0.0003 (0.74)	-0.0023 (-0.37)	-0.0020 (-0.32)	0.0275*** (2.84)
Log(sales)	-0.00004 (-0.10)	0.0152** (2.25)	0.0172** (2.50)	-0.1635*** (-17.09)	0.0002 (0.60)	0.0204*** (2.96)	0.0223*** (3.18)	-0.1592*** (-17.06)
Log(PPE/Emp)	0.0007 (1.25)	0.0059 (0.87)	0.0062 (0.85)	-0.0178* (-1.85)	0.0007 (1.35)	0.0068 (1.01)	0.0071 (0.98)	-0.0169* (-1.77)
Stock return	-0.0003 (-0.41)	-0.0211* (-1.85)	-0.0307*** (-2.79)	0.1910*** (6.84)	-0.0008 (-0.98)	-0.0281** (-2.44)	-0.0376** (-3.41)	0.1907*** (6.75)
Tobin's q	0.0001 (0.11)	-0.0045 (-0.89)	0.0007 (0.14)	-0.0127 (-1.08)	0.0001 (0.32)	-0.0028 (-0.56)	0.0024 (0.45)	-0.0113 (-0.96)
Sales growth	-0.0008 (-0.40)	-0.0366 (-1.36)	-0.0261 (-0.92)	0.2956*** (4.85)	-0.0014 (-0.69)	-0.0465* (-1.72)	-0.0360 (-1.26)	0.2915*** (4.76)
ROA	-0.0090 (-1.15)	-0.0578 (-0.67)	-0.0923 (-1.06)	-2.2941*** (-12.74)	-0.0105 (-1.34)	-0.0819 (-0.95)	-0.1162 (-1.34)	-2.3124*** (-12.68)
Book leverage	-0.0054* (-1.79)	0.0401 (0.98)	0.0479 (1.16)	0.4645*** (5.73)	-0.0056* (-1.85)	0.0379 (0.93)	0.0456 (1.11)	0.4634*** (5.73)
Cash	0.0072* (1.81)	0.1769*** (3.32)	0.1582*** (2.83)	1.8437*** (15.51)	0.0074* (1.86)	0.1805*** (3.39)	0.1614*** (2.89)	1.8472*** (15.60)
Log(1 + tenure)	-0.00001 (-1.17)	0.0001* (1.84)	0.0001 (1.40)	0.2956*** (-2.86)	-0.00001 (-0.93)	0.0001** (2.15)	0.0001* (1.69)	-0.0004*** (-3.43)
log(1 + delta)	-0.0001 (-0.32)	-0.0247*** (-3.75)	-0.0214*** (-3.10)	0.0200 (1.44)	-0.0004 (-1.04)	-0.0298*** (-4.43)	-0.0264*** (-3.67)	0.0136 (0.93)
log(1 + vega)	-0.0009** (-2.37)	-0.0315*** (-5.07)	-0.0315*** (-5.15)	-0.1584*** (-11.54)	-0.0008** (-2.24)	-0.0306*** (-4.91)	-0.0306*** (-4.98)	-0.1587*** (-11.57)
N	17,705	17,705	17,622	17,697	17,705	17,705	17,622	17,697
R ²	0.0185	0.1051	0.0418	0.4191	0.0242	0.1121	0.0488	0.4199

Panel B: CEO overconfidence, change in moneyness, and stock returns								
	(1) FF4 intercept (monthly)	(2) 1-Year B-H	(3) 1-Year B-H FF 10x10	(4) Stock volatility	(5) FF4 intercept (monthly)	(6) 1-Year B-H	(7) 1-Year B-H FF 10x10	(8) Stock volatility
PreOverconf CEO					0.0141*** (8.55)	0.1983*** (8.13)	0.1962*** (8.21)	0.1573*** (3.15)
PostOverconf CEO					0.0031*** (3.72)	0.0483*** (3.76)	0.0486*** (3.60)	0.1141*** (4.75)
Change in moneyness	0.0001 (0.17)	0.0070 (1.42)	0.0077 (1.52)	-0.1037*** (-10.53)	-0.0001 (-0.18)	0.0052 (1.05)	0.0060 (1.18)	-0.1028*** (-10.48)
Log(sales)	0.0001 (0.32)	0.0227*** (3.25)	0.0248*** (3.47)	-0.1470*** (-15.09)	0.0004 (0.82)	0.0263*** (3.72)	0.0284*** (3.90)	-0.1409*** (-14.15)
Log(PPE/Emp)	0.0006 (1.20)	0.0062 (0.90)	0.0070(0.93)	-0.0114 (-1.16)	0.0006 (1.26)	0.0068 (0.99)	0.0075 (1.01)	-0.0101 (-1.04)
Stock return	-0.0009 (-0.94)	-0.0389*** (-3.28)	-0.0475*** (-4.14)	0.2676*** (9.58)	-0.0013 (-1.38)	0.0450*** (-3.58)	-0.0535*** (-4.40)	0.2643*** (9.30)
Tobin's q	0.0001 (0.33)	-0.0029 (-0.56)	0.0034 (0.67)	-0.0034 (-0.26)	0.0002 (0.35)	-0.0028 (-0.55)	0.0034 (0.68)	-0.0049 (-0.37)
Sales growth	-0.0026 (-1.18)	-0.0592** (-2.22)	-0.0515* (-1.84)	0.2266*** (3.48)	-0.0032 (-1.48)	-0.0689** (-2.53)	-0.0612** (-2.13)	0.2124*** (3.24)
ROA	-0.0080 (-1.02)	-0.0608 (-0.69)	-0.0979 (-1.11)	-2.3538*** (-12.14)	-0.0098 (-1.24)	-0.0859 (-0.97)	-0.1230 (-1.38)	-2.3863*** (-12.15)
Book leverage	-0.0046 (-1.42)	0.0455 (1.11)	0.0505 (1.20)	0.4570*** (5.37)	-0.0045 (-1.40)	0.0466 (1.14)	0.0514 (1.23)	0.4595*** (5.41)
Cash	0.0050 (1.81)	0.1474*** (2.97)	0.1302** (2.41)	1.8137*** (14.56)	0.0050 (1.21)	0.1476*** (2.99)	0.1301** (2.42)	1.8155*** (14.67)
Log(1 + tenure)	-0.00001 (-1.17)	0.0001** (2.41)	0.0001* (1.88)	-0.0003*** (-2.77)	-0.00001 (-1.26)	0.0001** (2.28)	0.0001* (1.72)	-0.0004*** (-3.81)
log(1 + delta)	0.0005 (1.30)	-0.0212*** (-3.02)	-0.0182** (-2.42)	0.0438*** (3.17)	-0.00004 (-0.04)	-0.0297*** (-3.85)	-0.0266*** (-3.25)	0.0274* (1.87)
log(1 + vega)	-0.0013*** (-3.45)	-0.0371*** (-6.14)	-0.0364*** (-5.94)	-0.1984*** (-14.83)	-0.0010*** (-2.88)	-0.0339*** (-5.69)	-0.0332*** (-5.51)	-0.1934*** (-14.57)
N	17,705	17,705	17,622	17,697	17,705	17,705	17,622	17,697
R ²	0.0141	0.1218	0.0510	0.4183	0.0200	0.1275	0.0567	0.4199

Notes: This table shows the results from estimating the effects of CEO confidence on stock returns and return volatility controlling for the moneyness of the CEO's stock option portfolio. In Panel A, the level of moneyness is controlled for in the specifications, while the change in moneyness from year $t-2$ to year $t-1$ is controlled for in Panel B. The data sample period is from 1992 to 2010. The dependent variables in the first three specifications of Panel B are the intercept from a regression of twelve monthly returns on the Fama–French–Carhart (FF4) factors (FF4 Intercept), the one year buy-and-hold return (1-Year B-H), and the one year buy-and-hold return adjusted for the firm's Fama–French 10×10 portfolio (1-Year B-H FF 10x10), respectively. The dependent variable in specification 4 of Panel B is daily stock return volatility measured over the following fiscal year (Stock Volatility). PreOverconf CEO (PostOverconf CEO) is a dummy variable equal to 1 in the year of and before (in the years after) a CEO is identified as having unexercised exercisable options that are at least 67% in the money, on average, for the second time. All independent variables are lagged. Year and industry fixed effects are controlled by dummies. Standard errors are two-way cluster adjusted by industry and year (Peterson, 2009). Test statistics are reported in parentheses. See the Appendix for detailed variable explanations.

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

Table 10
CEO overconfidence, information asymmetry, and stock returns.

	(1) FF4 intercept (monthly)	(2) 1-Year B-H	(3) 1-Year B-H FF 10x10	(4) Stock volatility
PreOverconf CEO	0.0136*** (9.29)	0.2076*** (8.78)	0.2059*** (9.10)	0.0903*** (2.84)
PostOverconf CEO	0.0026*** (2.86)	0.0333** (2.57)	0.0333** (2.45)	0.0511*** (3.03)
Firm age	-0.00003 (-0.79)	-0.0010** (-2.39)	-0.0010** (-2.37)	-0.0096*** (-16.06)
CPIMC	0.000001 (1.06)	0.000001 (1.27)	0.000001** (2.30)	-0.000001*** (-2.79)
CVOL	0.0028 (0.87)	0.0964 (1.39)	0.1133* (1.68)	0.8391*** (5.49)
SIGMA	0.0215* (1.70)	0.6004** (2.29)	0.4634* (1.81)	11.3714*** (32.40)
Log(sales)	0.0002 (0.39)	0.0241*** (3.08)	0.0242*** (2.96)	-0.0469*** (-5.78)
Log(PPE/Emp)	0.0006 (1.10)	0.0056 (0.82)	0.0057 (0.77)	-0.0098 (-1.33)
Stock return	-0.0009 (-1.14)	-0.0375*** (-2.96)	-0.0449*** (-3.72)	0.0433** (2.17)
Tobin's q	-0.00004 (-0.08)	-0.0080* (1.65)	-0.0031 (-0.65)	-0.0086 (-0.90)
Sales growth	-0.0025 (-1.10)	-0.0712** (-2.45)	-0.0590* (-1.94)	0.1207*** (2.83)
ROA	-0.0073 (-0.91)	-0.0278 (-0.34)	-0.0670 (-0.80)	-1.2163*** (-10.07)
Book leverage	-0.0053* (-1.75)	0.0200 (0.51)	0.0307 (0.76)	0.1238** (2.31)
Cash	0.0048 (1.21)	0.1136** (2.30)	0.0977* (1.90)	0.9948*** (11.93)
Log(1 + tenure)	-0.00001 (-0.97)	0.0001** (2.31)	0.0001* (1.78)	-0.0002*** (-2.12)
log(1 + delta)	-0.0002 (-0.50)	-0.0297*** (-4.27)	-0.0263*** (-3.54)	0.0025 (0.29)
log(1 + vega)	-0.0007** (-2.13)	-0.0229*** (-4.57)	-0.0242*** (-4.65)	-0.0678*** (-9.02)
N	17,705	17,705	17,622	17,697
R ²	0.0240	0.1168	0.0521	0.6519

Notes: This table shows the results from estimating the effects of CEO confidence on stock returns and return volatility while controlling for asymmetric information. The data sample period is from 1992 to 2010. The dependent variables in the first three specifications are the intercept from a regression of twelve monthly returns on the Fama–French–Carhart (FF4) factors (*FF4 Intercept*), the one year buy-and-hold return (*1-Year B-H*), and the one year buy-and-hold return adjusted for the firm's Fama–French 10 × 10 portfolio (*1-Year B-H FF 10x10*), respectively. The dependent variable in specification 4 is daily stock return volatility measured over the following fiscal year (*Stock Volatility*). *PreOverconf CEO* (*PostOverconf CEO*) is a dummy variable equal to 1 in the year of and before (in the years after) a CEO is identified as having unexercised exercisable options that are at least 67% in the money, on average, for the second time. All independent variables are lagged. Our independent variables capturing information uncertainty follow Zhang (2006). *Firm Age* is the number of years since the firm first has data reported by CRSP. *CPIMC* is the firm's CPI-adjusted market capitalization. *CVOL* is the standard deviation of cash flow from operations over the previous five years, with a requirement of at least three years of data. *SIGMA* is the standard deviation of weekly market excess returns over the previous one year. Year and industry fixed effects are controlled by dummies. Standard errors are two-way cluster adjusted by industry and year (Peterson, 2009). Test statistics are reported in parentheses. See the Appendix for detailed variable descriptions.

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

to have higher future return volatility. Also, *SIGMA* is positively related to all three return performance measures, with significance at the 90% or higher confidence level. Firm age is significantly negatively related to the *1-Year B-H* and *1-Year B-H FF 10x10* return measures. Therefore, we conclude that CEO overconfidence creates value for the firm and this value is not due to information asymmetry, which may lead to inside information.

6. Conclusion

While Gervais et al. (2011) and Goel and Thakor (2008) suggest that CEO overconfidence could enhance firm value, no study to date has examined the unconditional effect of CEO overconfidence on firm value creation. By studying a large sample of companies in ExecuComp's database from 1992 to 2010, we provide evidence to strongly support the theoretical predictions that overconfident CEOs create more value for a firm through superior stock return performance and that they take more risk. Specifically, overconfident CEOs in our sample produce roughly 3.00%–4.50% more stock return on an annual basis, depending on the return measure, relative to their non-overconfident counterparts. We also examine whether there is a systematic difference in the link between CEO overconfidence and value addition across innovative and non-innovative in-

dustries. This distinction by innovation is made by [Hirshleifer et al. \(2012\)](#), who show that CEO overconfidence is associated with higher next-year Tobin's q in the presence of growth opportunities, only in innovative industries. We find that CEO overconfidence adds firm value in innovative and non-innovative industries. We also find that founder CEOs add some value to the firm and take higher risks, independent of overconfidence, which lends some support to the results of [Fahlenbrach \(2009\)](#). In addition, we find some evidence that overconfident CFOs add little firm value beyond what is already added by CEO overconfidence.

Finally, our findings provide support for [Goel and Thakor's \(2008\)](#) prediction that overconfident CEOs are hired less frequently, take less risk, and add less firm value after the implementation of the Sarbanes–Oxley Act, which includes strict penalties for poorer quality information disclosures. Given the literature on the effect of CEO overconfidence on firm policy decisions, firm value, and risk taking, future inquiry into these topics should consider the effect of the Sarbanes–Oxley Act.

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Appendix

The table provides variable definitions.

Variable	Definition
<i>Dependent Variables</i>	
Annual Return	Fiscal year buy-and-hold return on a firm's stock
Annual Abnormal Return	Fiscal year buy-and-hold return on a firm's stock relative to its Fama–French 10 × 10 portfolio based on size and book-to-market
Fama–French–Carhart (FF4) Monthly Intercept	The intercept from a regression of twelve monthly returns on the Fama–French–Carhart factors
Stock Return Volatility	Standard deviation of daily stock returns
Moneyiness	Estimated realizable value of exercisable options divided by the estimated average exercise price using Core and Guay's (2002) approximation method
<i>CEO Confidence Variables</i>	
PreOverconf CEO	Dummy variable equal to 1 in the year of and before a CEO is identified as having unexercised exercisable options that are at least 67% in the money, on average, for a second time; zero otherwise
PostOverconf CEO	Dummy variable equal to 1 for each year after a CEO is identified as having unexercised exercisable options that are at least 67% in the money, on average, for a second time; zero otherwise
NonOverconfident CEO	Dummy variable equal to 1 if a CEO never has unexercised options more than 67% in the money, on average, twice; zero otherwise
<i>Industry Specifications</i>	
Innovative Industry	Dummy variable equal to 1 if the company is in an industry that is classified as innovative for more than 80% of the years in Hirshleifer et al. (2012) ; zero otherwise
High-Tech Industry	Dummy variable equal to 1 if the company is in one of the high-tech industries defined by Loughran and Ritter (2004) ; zero otherwise
<i>Other Independent Variables</i>	
Book Leverage	The sum of total current liabilities and total long-term debt scaled by total assets (Compustat: (DLC + DLTT)/AT)
Cash	Cash and short-term investments scaled by total assets (Compustat: CHE/AT)
PPE/Emp	Net property, plant, and equipment per employee in thousands (Compustat: PPENT/EMP)
ROA	Ratio of operating income before depreciation and amortization to total assets (Compustat: EBITDA/AT)
Sales	Net sales in millions of 2000 dollars
Sales Growth	Log transformation of sales divided by previous-year sales
Stock Return	The intercept from a regression of 12 monthly returns on the Fama–French–Carhart factors (previous year)
Tenure	Number of months since the current CEO became in charge
Tobin's q	Ratio of market value to book value of assets (Compustat: (AT – CEQ + CSHO × PRCC_F)/AT)
Firm Age	Number of years since the firm first appeared in CRSP database
CPIMC	Firm's CPI-adjusted market capitalization
CVOL	Standard deviation of cash flow from operations over the previous five years
SIGMA	Standard deviation of weekly market excess returns over the previous one year
Delta	Dollar change in CEO stock and option portfolio for a stock price change of 1%
Vega	Dollar change in CEO stock and option portfolio for a stock return volatility change of 1%

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