

ARE FOUNDER CEOs MORE OVERCONFIDENT THAN PROFESSIONAL CEOs?

EVIDENCE FROM S&P 1500 COMPANIES

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We provide evidence that founder CEOs of large S&P 1500 companies are more overconfident than their non-founder counterparts (“professional CEOs”). We approximate overconfidence via CEO tweets, CEO statements during earnings-conference calls, management-earnings forecasts, and CEO option-exercise behavior. Compared with professional CEOs, founder CEOs use more optimistic language on Twitter and during earnings-conference calls. In addition, founder CEOs are more likely to issue earnings forecasts that are too high; they are also more likely to perceive their firm to be undervalued as implied by their option-exercise behavior. To date, investors appear unaware of the “overconfidence bias” among founders.

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INTRODUCTION

Many U.S. companies are managed by founder CEOs, including some of the largest firms, such as Google, Facebook, and Amazon (e.g., Certo *et al.*, 2001; Fahlenbrach, 2009; Nelson, 2003; Villalonga and Amit, 2006; Villalonga and Amit, 2009). Given the economic significance of these large founder-managed firms, a growing body of work compares the behavior and performance of large firms managed by founder CEOs to those managed by professional CEOs. For example, Fahlenbrach (2009) finds in his sample of mostly S&P 500 firms that founder-CEO firms invest 22% more in R&D, have 38% higher capital expenditures, and make more focused M&As than professional-CEO firms. In their study of Fortune 500 companies, Villalonga and Amit (2006) find that founder-managed firms have higher firm-valuation ratios than their non-founder-managed counterparts.

These studies point to substantial differences between large firms managed by founder CEOs and those managed by professional CEOs. Yet, we know relatively little about the attributes of founder CEOs and professional CEOs that lead to these differences in the first place.¹ Our purpose in this paper is to identify one such attribute. Specifically, we conjecture that founder CEOs are more overconfident (optimistic)² than professional CEOs. Overconfidence is the tendency of individuals to think that they are better than they truly are with respect to their abilities, judgments, and/or future prospects, as well as the underestimation of risk (Barber and Odean, 2001; Dushnitsky, 2010; Malmendier and Tate, 2005; Simon and Houghton, 2003).

¹ Recently, scholars have started to focus on the sources of differences between founder CEOs and professional CEOs (e.g., Certo *et al.*, 2001; Fahlenbrach, 2009; Lee, 2013; Nelson, 2003; Villalonga and Amit, 2006; Villalonga and Amit, 2009) in large public companies. These scholars have argued that founder CEOs differ from professional CEOs in the following ways: Founder CEOs often consider their firm to be their “baby or legacy,” and their attitudes toward risk differ from those of professional CEOs. Founder CEOs are also often more knowledgeable about their firm and are better networked with their employees. However, empirical evidence on these differences is scarce, leaving the door open for future research.

² A large body of literature exists on overconfidence (e.g., Hayward and Hambrick, 1997; Malmendier and Tate, 2005; Navis and Ozbek, 2015; Simon and Houghton, 2003) and optimism (e.g., Dushnitsky, 2010; Lowe and Ziedonis, 2006). Following previous studies (e.g., Cassar, 2010; Landier and Thesmar, 2009), we use overconfidence and optimism interchangeably.

Our suspicion draws from two sources: (1) The literature documenting that the *average* CEO is overconfident, but that there is also a lot of variation (Galasso and Simcoe, 2011; Hayward and Hambrick, 1997; Hirshleifer, Low, and Teoh, 2012; Hribar and Yang, 2013; Malmendier and Tate, 2005, 2008), and (2) the literature trying to understand why entrepreneurs participate in start-up activities even though few new venture firms succeed.

Regarding the latter source, entrepreneurship scholars have long considered the possibility that entrepreneurs have higher dispositional optimism than non-entrepreneurs (e.g., Camerer and Lovallo, 1999; Cooper, Woo, and Dunkelberg, 1988; Lowe and Ziedonis, 2006). Empirical work suggests that, in general, founders of small startup firms are more overconfident than professional managers of small and/or large organizations.³ Busenitz and Barney (1997) explore differences in cognitive biases between founders/entrepreneurs in (small) startup firms and executives in large organizations. Using survey data from 219 entrepreneurs and professional managers, Busenitz and Barney find that entrepreneurs show significantly greater confidence than professional managers. Forbes (2005) uses survey data from 108 entrepreneurs and non-founding managers of new venture firms to show that founder-managers are more confident than professional managers working for companies in their entrepreneurial stage.

These studies help us understand the behavior of founder CEOs in small startup companies. However, whether founder CEOs' overconfidence sustains or reduces after the inception stage, especially as firms develop into large publicly traded companies, is not obvious (Wasserman, 2003): Previous studies on corporate life cycles find that characteristics required of successful CEOs in new startups are significantly different from characteristics required of successful CEOs in large organizations (Boeker and Karichalil, 2002; Hambrick and Crozier,

³ The average firm age of founder-led firms in the samples of Busenitz and Barney (1997) and Forbes (2005) are 1.7 years and 2 years, respectively.

1986). Founder CEOs who fail to adapt to their new role as a manager of a large organization and, in some regard, fail to become more like a professional CEO, may therefore be replaced.

We contribute to the literature (1) by providing theoretical arguments for why founder CEOs of large publicly traded companies continue to be more overconfident than their professional counterparts, and (2) by taking our prediction to the data using novel, hand-collected data. To the best of our knowledge, we are the first to conduct this kind of analysis.

Our sample contains S&P 1500 companies from 2008 through 2012. Our proxies for overconfidence are as follows: (a) CEO tweets, (b) statements made by the CEO during earnings conference calls, (c) top management's prediction of the company's future earnings ("management earnings forecast"), and (d) the degree to which the CEO exercises his/her exercisable in-the-money options.

In our first test, we build on findings from prior literature that the fraction of negative words in a text captures the tone of the text (e.g., Das and Chen, 2007; Li, 2008; Loughran and McDonald, 2011; Tetlock, 2007; Tetlock, Saar-Tsechansky, and Macskassy, 2008). We find that founder CEOs use substantially fewer negative words in their personal tweets than professional CEOs. We make analogous observations in our second test, which looks at CEO statements during earnings conference calls. These differences in tone cannot be explained by differences in firm performance and suggest that founder CEOs are more confident than professional CEOs.

Our third test builds on prior literature suggesting that firm management has strong incentives to lower investors' earnings expectations prior to earnings announcements to make it easier for the firm to meet or beat the consensus forecast (e.g., Bergman and Roychowdhury, 2008; Matsumoto, 2002). In sharp contrast to professional CEOs, we find that founder CEOs frequently issue earnings forecasts that are too high relative to actual earnings.

Our fourth test utilizes options data. CEOs receive large grants of options as part of their compensation. As CEOs' fortunes are intimately linked to their firms in terms of both human capital and financial wealth, CEOs should exercise their exercisable in-the-money options as early as possible (in order to diversify), unless they are overconfident about their firm's future returns (Malmendier and Tate, 2005). Our analysis implies that founder CEOs are substantially more overconfident than professional CEOs in the sense that they hold on to too many options.

Taken together, our results across our four settings indicate that founder CEOs of large publicly traded companies are more overconfident than their professional counterparts.

In subsequent tests, we extend our analysis to non-CEO executives. Using options data, we provide evidence that founder CEOs are more overconfident than non-CEO executives working at founder firms. At the same time, non-CEO executives working at founder firms are more overconfident than their counterparts working at professional-CEO-managed firms. We discuss potential explanations for these differences in the main body of the text.

In our final analysis, we present evidence that, to date, investors are unaware of the overconfidence bias among founders documented herein and, instead, take founder CEOs' statements at face value. Specifically, we show that investors react just as much to the tone of tweets from founder CEOs as they do for professional CEOs despite our evidence that tweets from founder CEOs are generally much more positive and that this difference in tone cannot be explained by firm performance.

In sum, we contribute to the management and finance literature by being the first to produce systematic evidence of strong differences in the level of overconfidence between founder CEOs and professional CEOs within the largest and, economically speaking, most relevant organizations in the marketplace. Further, we suggest that investors in the market are yet unaware of this particular overconfidence bias.

THEORY AND HYPOTHESES

Overconfidence as a managerial bias

Management and psychology scholars provide strong evidence that individuals tend to overestimate their own abilities. For example, Bazerman and Moore (2012) find that most people are overconfident in estimating their own abilities and that they do not assess the actual uncertainty correctly. Similarly, Svenson (1981) reports that the vast majority of subjects in his study regard themselves as more skillful and less risky than the average driver.

Top management executives are known to be particularly vulnerable to this bias, as overconfidence is stronger among highly skilled individuals than among less skilled individuals (Camerer and Lovo, 1999). The implications of this particular cognitive bias have been widely studied in the management and finance literature, both conceptually and empirically. In a conceptual study on managerial overconfidence, Roll (1986) argues that corporate takeovers may be explained by the overconfidence of acquiring firms' top managers. Building on Roll's work, Hiller and Hambrick (2005) suggest that overconfidence and optimism lead to faster, less comprehensive, and more centralized decisions and higher-stake strategic actions.

Complementing the theoretical work on managerial overconfidence, Malmendier and Tate (2008) develop options-based proxies for CEO overconfidence and provide evidence that more overconfident CEOs, to a greater degree, overestimate their ability to generate returns and are more at risk to overpay for target companies and to undertake value-destroying M&As. Hribar and Yang (2013) present evidence that more overconfident CEOs are more likely to issue overly optimistic management earnings forecasts.

On a more positive note, Hirshleifer *et al.* (2012) suggest that firms with more overconfident CEOs invest more in innovation, obtain more patents, and achieve greater

innovative success than other firms. Relatedly, Galasso and Simcoe (2011) find a positive association between proxies of overconfidence and innovative behavior.

The aforementioned literature points to substantial variation in the level of overconfidence and provides evidence that variation in overconfidence captures differences in firm behavior. But where does this variation in CEO overconfidence come from? Which managers are more overconfident than others?

Founder CEOs in entrepreneurial firms versus professional CEOs

A large body of work investigates the overconfidence bias among entrepreneurs. While many people participate in start-up activities every year, few ventures succeed, and most ventures fail within a few years (Cooper *et al.*, 1988). Scholars attribute this phenomenon to an “overconfidence bias” among entrepreneurs (e.g., Koellinger, Minniti, and Schade, 2007; Shepperd, Ouellette, and Fernandez, 1996). Specifically, people who choose to become entrepreneurs tend to overestimate their own abilities and tend to underestimate the amount of risk that is involved in starting a new venture (Busenitz and Barney, 1997; De Meza and Southey, 1996). For example, using survey data on 2,994 founding executives, Cooper *et al.* (1988) find that founders often perceive the odds of success of their new venture to greatly exceed those of similar startups. Similarly, Camerer and Lovallo (1999) use experiments to study entrepreneurial decision making on market entry. The authors find that although participants accurately estimate that, on average, the expected value of starting a new business is negative, founding activity still occurs, perhaps as participants overestimate the prospect for success for their *own* particular venture.

The literature above does not suggest that entrepreneurs have a higher tolerance for risk (e.g., Brockhaus and Howtz, 1982; Kahneman and Lovallo, 1993). Instead, entrepreneurs have

biased beliefs and overestimate their own odds of success and underestimate the amount of risk involved (Busenitz and Barney, 1997). In other words, it is not the risk-taking tendency of entrepreneurs *per se* but the misunderstanding of the true probability distribution that, in the end, makes entrepreneurs take on more risks than their counterparts.

In contrast to entrepreneurs, professional CEOs often start at the bottom of the pyramid and rise to the CEO position through an “internal horserace” which requires professional CEOs to become more rational, conservative, and realistic (e.g., Busenitz and Barney, 1997; Pfeffer and Lammerding, 1981). Employees that fail to learn and adapt to the needs and norms that large organizations require (e.g., professionalism, conservatism) are often eliminated during the internal selection process (Schneider, 1987; Tsui, Egan, and O'Reilly III, 1992). Consequently, professional managers in existing firms use (relatively speaking) more rational decision-making processes and are more analytical and realistic (Fraser and Greene, 2006; Hayes and Abernathy, 1980; Smith *et al.*, 1988). In the end, the literature generally suggests that the overconfidence level of *founder CEOs of new venture firms* is higher than that of *professional CEOs*.

Founder CEOs in large public firms versus professional CEOs

While suggestive, the aforementioned evidence does not allow us to make strong statements regarding overconfidence levels of CEOs within large organizations. Founder CEOs are often pressured to adjust their characteristics to become more suitable for leading large organizations. The corporate life cycle literature suggests that as new startups grow significantly, managerial styles and capabilities of CEOs must evolve as priorities shift from viability and survival to managing complex organizational systems (Boeker and Karichalil, 2002; Jain and Tabak, 2008; Tushman and Romanelli, 2008). The transition to a large public corporation exposes CEOs to a new set of tasks resulting from changes in the ownership- and governance structure, increased

market monitoring, and pressure to meet analyst expectations (Jain and Tabak, 2008). Thus, the characteristics that large companies require from their CEOs (e.g., management skill, meeting investor needs, rational decision making) are significantly different from characteristics that new startups require from their CEOs (e.g., entrepreneurial passion, visionary, risk-taking) (Boeker and Wiltbank, 2005; Wasserman, 2012). If founder CEOs fail to adapt to the new needs and conditions that large organization require, they are often replaced by professional CEOs (Boeker and Fleming, 2010). Thus, founder CEOs in large organizations may become to think and behave more like professional CEOs who make more rational, realistic, and logical decisions.

At the same time, studies on entrepreneurial optimism and managerial overconfidence hint at the possibility that founder CEOs remain overconfident, even as their startups become large publicly traded firms. The literature on entrepreneurial optimism suggests that founder CEOs' overconfidence largely comes from inherent disposition (e.g., Hmieleski and Baron, 2009; Lowe and Ziedonis, 2006), which makes it difficult for founder CEOs to adjust their level of overconfidence even as they become leaders of large organizations. For example, De Meza and Southey (1996) argue that entrepreneurs are born overconfident and have unrealistic expectations by nature. Hayward, Shepherd, and Griffin (2006) and McCarthy, Schoorman, & Cooper (1993) suggest that founder CEOs' overconfidence level persists over time. Hence, while founder CEOs may alter certain personal characteristics following the growth stage of their firms, they are unlikely to materially alter their level of overconfidence which is spawned from inherent disposition. Viewed from this angle, we may expect the overconfidence level of founder CEOs to remain higher than that of professional CEOs even within the set of large organizations.

Drawing from the literature on managerial overconfidence, one may argue that the overconfidence level of founder CEOs even increases as their firms develop into large public companies. Founder CEOs spearheading organizations that eventually become large publicly

traded companies have beaten extreme odds as most of their fellow entrepreneurs fail during the entrepreneurial stage or falter in the post-IPO stage. That is, they have survived immense “external competition” (Camerer and Lovo, 1999). Founder CEOs are likely to attribute much of that success to themselves (Hayward and Hambrick, 1997), which can inflate their level of confidence.

In addition, founder CEOs’ biographies are often romanticized as stories of “an underdog who, against all odds, rose to the top” (Chatterji, 2009). Perhaps as a result, founder CEOs tend to receive more attention from the media and more favorable coverage both of which can increase the level of overconfidence.

We therefore propose the following hypothesis:

Hypothesis: Holding all else equal, founder CEOs of large publicly traded firms are more overconfident than their professional counterparts.

EMPIRICAL SETTINGS

This section describes the sample and introduces our main variables of interest. Our sample contains S&P 1500 firms from 2008 through 2012. To measure overconfidence, we use data on CEOs’ Twitter posts, statements in earnings conference calls, management earnings forecasts, and option-exercise behavior. For our control variables, we use financial statement, financial market, financial analyst, and institutional holding data from COMPUSTAT, the Center for Research in Security Prices (CRSP), the Institutional Brokers’ Estimate System (IBES), and Thomson Reuters, respectively. We collect biographical data from Marquis Who’s Who.

Dependent variable: Measures of overconfidence

Our empirical analysis compares founder CEOs with professional CEOs within a sample of large S&P 1500 companies using the following four proxies for overconfidence: (a) CEO tweets, (b) CEO statements made during earnings conference calls, (c) management earnings forecasts, and (d) the degree to which the CEO exercises his/her exercisable in-the-money options.

Prior literature gauges entrepreneur's overconfidence level at the personal level through surveys and direct questioning of the entrepreneur him-/herself. However, overconfidence at the personal level may not survive within a group setting as CEOs' actions are constantly monitored and influenced by other actors (e.g., other corporate executives, directors, auditors, investor relation firms).

Put differently, in order to explain differences in firm behavior via CEO overconfidence, it is a *necessary condition* that some CEOs are more overconfident than others and prior literature produces important evidence on this matter (e.g., Busenitz and Barney, 1997; Forbes, 2005). However, CEO overconfidence by itself is not a *sufficient condition* to explain differences at the firm level as CEO overconfidence might not express itself at the group level and, thus, may not translate into differences in firm behavior.

Our empirical setting is unique in that we utilize a full set of measures, which, taken together, capture both overconfidence at the personal level and the group level. Utilizing the full set of measures alleviates concerns of an omitted variable bias and adds strength to the argument that it is truly overconfidence that is causing the observed difference in firm behavior and performance.⁴

⁴ Our paper also differs from Busenitz and Barney (1997) and Forbes (2005) by using a secondary data approach rather than a survey approach. Our secondary data approach has the advantage of utilizing data that are systematically available, which renders our measures attractive for use in future studies. Furthermore, our measures are likely to capture both the more obvious and the more subconscious/spontaneous forms of overconfidence, which are difficult to capture in survey responses.

Here, we discuss each proxy's strengths and differentiating features: (a) CEO tweets can be work-related (e.g., "*Earnings call. T- 1 hr away. I enjoy taking a step back from the day to day and reflecting on all we have accomplished over the past qtr,*" a tweet sent by John Heyman, former CEO of Radiant Systems, on 10/29/2009). However, they can also reflect personal mood and views with no direct bearing on the CEO's organization (e.g., "*About to land in CT. Time to switch from global econ and hyper-development to legalized pot, Sunday booze and a debate on min wage. Oh well,*" a tweet sent by Mark T. Bertolini, current CEO of Aetna, on 3/20/2012).

As such, CEO tweets likely capture how a CEO directly feels about his/her business; they also capture how he/she feels about his/her overall life. How a CEO feels about his/her overall life, in turn, can indirectly, yet importantly, affect a firm's investment and financing decisions (e.g., Cain and McKeon, 2014; Chyz, 2013; Cronqvist, Makhija, and Yonker, 2012). CEO tweets also provide a relatively uncensored and, consequently, clean picture of a CEO's personal traits. These features are not shared by the other three proxies. In that regard, CEO tweets provide the most complete picture of a CEO's *personal* level of confidence.

(b) Compared with CEO tweets, CEO statements made during earnings conference calls are more likely to be prepared/well-reflected upon and influenced by other parties such as the auditor and the investor relations company.

(c) Management earnings forecasts are also well reflected upon and reflect a more conscious form of confidence pertaining directly to the firm. They are also made in conjunction with other parties and allow us to capture to what degree CEO overconfidence persists within a group and translates into actual firm behavior. The appealing feature of management earnings forecasts is that a clear benchmark exists, namely, actual earnings, against which management's reported earnings forecast can be compared to.

(d) Overconfidence inferred via CEO option-exercise behavior reflects *personal* confidence pertaining directly to a firm. Given that option-exercise behavior has important implications for the CEO's personal wealth, it is likely well reflected upon. An important restriction is that the decision to exercise an option is co-determined by a host of factors such as tax considerations and liquidity considerations (i.e., how much cash the CEO needs at hand), which are difficult to fully control for (e.g., Malmendier and Tate, 2005). We now detail our data collection efforts and our variable construction for each of our four proxies for overconfidence.

CEO tweets. Twitter is a social media outlet that allows a user to post short messages with a maximum of 140 characters to his/her network of followers. These short messages are referred to as microblogs or, more commonly, as "tweets."

We start with the complete list of CEOs in Execucomp (as of the time of the download) and locate users with an active Twitter account that have the same first and last names as the CEO in question. We then cross-check the executive's middle name, gender, and company information with the user characteristics associated with the Twitter account; we also read the tweets in an attempt to determine whether any account that we find, indeed, belongs to the executive in question. We separate out Twitter accounts that are managed by firms. The first tweet from an S&P 1500 CEO's personal Twitter account was sent in April 2008, which marks the beginning of our sample period. Our sample ends in December 2012. After adding our control variables, our final sample for the CEO tweets analysis contains 71 CEOs from 71 firms.

To capture confidence, we build on prior literature, which suggests that the frequency of negative words used in a text captures the tone of the text (e.g., Das and Chen, 2007; Loughran and McDonald, 2011; Tetlock, 2007). Any neutral text should contain a baseline number of negative words. Writers who are pessimistic should use more negative words. Writers who are

optimistic and overconfident should avoid negative language. We use the negative words list compiled by Loughran and McDonald (2011), which they designed specifically for use in management and economics studies.⁵

Our first measure of CEO confidence is a continuous variable that equals the average fraction of negative words used across all tweets posted by the focal CEO in a day, *Neg. Tweets*. The observations are on a CEO-firm/day level. A lack of negative words implies that the CEO is confident. Therefore, the lower the value for *Neg. Tweets* is, the more confident we deem the CEO to be.

Earnings conference calls. Our second measure of CEO overconfidence is similar to the first measure, but we now compute the fraction of negative words across CEO statements made during conference calls discussing the firms' quarterly earnings. Processing all quarterly earnings conference calls for all S&P 1500 firms is not feasible. We therefore construct a random subsample via stratified random sampling of S&P 1500 firms based on industry with a sampling fraction of 10%. We download the quarterly earnings conference call transcripts for each firm in our subsample from the CQ FD disclosure database over our 2008-2012 sample period. In total, we have 160 CEOs from 133 firms with transcript data and with the data to construct the controls used in our regression analysis.

Our second measure of CEO overconfidence is a continuous variable that equals the fraction of negative words used by the focal CEO during the conference call discussing quarterly earnings, *Neg. Calls*. The observations are on a CEO-firm/quarter level. Again, the lower the value of *Neg. Calls* is, the more confident we deem the CEO to be.

⁵ The full word list can be seen here: http://www.nd.edu/~mcdonald/Word_Lists.html.

Management earnings forecasts. Management sometimes makes predictions for firms' upcoming earnings announcements, and both investors and sell-side analysts pay close attention to management earnings forecasts (Baginski and Hassell, 1990; Pownall, Wasley, and Waymire, 1993). Management earnings forecasts have been found to be "pessimistic," as the vast majority of actual earnings are above management earnings forecasts, and it has been argued that this bias arises from management's desire to lower earnings expectations prior to earnings announcements in order to reduce the possibility of a negative earnings shock, which would upset investors (e.g., Bergman and Roychowdhury, 2008; Matsumoto, 2002).

Given that managers have an incentive to issue earnings forecasts that are too low (relative to their true expectations), the degree to which issued earnings forecasts are above actual earnings provides information about management's overconfidence level.

The backbone of our analysis is the FirstCall database. Our third measure of CEO overconfidence, *Misguidance*, is a continuous variable, which equals the difference between forecasted quarterly earnings-per-share (EPS) and actual quarterly EPS, scaled by lagged price-per-share. The observations are on a CEO-firm/quarter level. Our final sample contains 714 CEOs from 652 S&P 1500 firms that provide earnings guidance during our sample period as per the FirstCall database.

CEO options. Our final measure of CEO overconfidence draws from CEOs' option-exercise behavior. CEOs receive a substantial portion of their pay in the form of call options. Given that a substantial portion of CEOs' human and financial capital is tied to the firms they work for, it is generally optimal for CEOs to exercise their exercisable in-the-money options as soon as possible and to exchange them for cash, which is no longer tied to the success or failure of the firm in question (e.g., Hall and Murphy, 2002; Lambert, Larcker, and Verrecchia, 1991).

Delaying the exercise of options implies that the CEO is overly optimistic and overconfident about the firm's prospects (e.g., Li, 2008; Malmendier and Tate, 2005; Malmendier and Tate, 2008; Schrand and Zechman, 2012).

Our data source is the Execucomp database, which compiles information on the compensation packages of S&P 1500 executives from the corresponding firms' annual financial statements. We follow Dezsö and Ross (2012) and construct the natural log transformation of the ratio of the focal CEO's vested in-the-money option value to the CEO's total compensation value (all by fiscal year), *Options*.⁶ The observations are on a CEO-firm/year level. In total, we have 1,392 CEOs from 1,238 firms with the data to perform our regression analysis.

As a robustness check, in untabulated analyses, we follow Schrand and Zechman (2012) and we compute, for each firm-year, the natural logarithm of the value of the CEO's unexercised but exercisable in-the-money options. If the natural logarithm is above the 3-digit industry median, the CEO is deemed to be overconfident; otherwise, the CEO is deemed to be not overconfident. We find that the results are very similar to the ones presented in this study (results available upon request).

Independent variable: founder CEO versus professional CEO

To determine whether a CEO is the founder or co-founder of a company, we utilize public information from multiple sources. First, we check the company's official website and SEC filings to determine whether it provides information on the company's founder or co-founders. Second, we conduct a Google search by using the company name plus the word "founder" to determine whether Google has compiled a list of founders/co-founders for the company in question. Third, we seek out the CEO's profile page on Bloomberg Businessweek, Forbes, and

⁶ Specifically, we use Execucomp's TDC1 field. Using TCC, which is a variant of total compensation, does not alter our findings.

Wikipedia. In many cases, we also search for the company's profile page on these websites to double check the validity of the information that we obtain. Our main explanatory variable, *Founder CEO*, equals one for founder CEOs and zero for professional CEOs. In our regression analyses using Twitter data, we find that 22 out of 71 CEOs are founder CEOs. In our regression analyses using conference call data, we find that 15 out of 160 CEOs are founder CEOs. In our regression analyses using management earnings forecasts, we find that 90 out of 714 CEOs are founder CEOs. Finally, in our regression analyses using CEO options data, we find that 159 out of 1,392 CEOs are founder CEOs.

CEO-specific control variables

Building on prior literature on managerial overconfidence, we include a number of CEO-specific and firm-specific control variables (e.g., Galasso and Simcoe, 2011; Hayward and Hambrick, 1997; Hirshleifer *et al.*, 2012; Hribar and Yang, 2013; Malmendier and Tate, 2005; Malmendier and Tate, 2008). *CEO Age* denotes the age of the focal CEO at the time of the explained variable's measurement. *CEO Tenure* is the number of years the executive has been the CEO of the focal firm. *Male* equals one if the CEO is male and zero otherwise.

One concern pertaining to our option-exercise analysis is that CEO wealth is correlated with both CEO options exercise behavior and whether the CEO is a founder or not. To address this omitted variable concern, we construct *CEO Wealth*, which denotes the wealth of the focal CEO at the time of the explained variable's measurement. We follow Dittmann and Maug (2007) and turn to the Execucomp database, which tracks all executives of S&P 1500 firms and the compensations they receive starting in 1992. To estimate a CEO's wealth at a given point in time, we take his/her stock holdings and cumulate all historical compensation-related cash

inflows received up to that point in time (adjusted for taxes) and we assume that the rate of return the CEO earned on his/her previously received cash inflows is that of a typical savings account.⁷

Firm-specific control variables

We use financial statement, financial market, financial analyst, and institutional holding data from COMPUSTAT, CRSP, IBES, and Thomson Reuters, respectively, to construct the following firm-specific control variables: *Log(Size)*, *Log(Market-to-Book)*, *Monthly Volatility*, *Institutional Holdings*, *Log(Price)*, *Earnings Surprise*, *Past Stock Market Performance* and *ROA*.

Size is a firm's market value of equity as of the month prior to the month of the explained variable's measurement. *Market-to-book* is a firm's market value of assets, divided by its book value of assets, measured as of the most recent fiscal year end. *Monthly Volatility* is the standard deviation of a firm's daily stock return in the month prior to the month of the explained variable's measurement. *Institutional Holdings* is a firm's fraction of shares held by institutional investors, measured as of the most recent calendar-quarter end. *Price* is a firm's share price as of the month prior to the month of the explained variable's measurement.

Earnings Surprise is the difference between the most recent reported quarterly EPS and the corresponding consensus forecast (both from IBES), scaled by the lagged price-per-share. For the CEO tweets analysis, which is conducted at the firm-day level, this variable is set to zero when no earnings announcement is made at the time of the tweet; for the CEO tweets analysis, we also include *I(Earnings Announcement)* denoting whether an earnings announcement was made to differentiate between no earnings announcement and earnings announcement where the earnings surprise was truly zero.

⁷ Specifically, a CEO's cash inflow in a given year is the sum of salary, bonus and other compensation net of taxes, plus the value of stock awards, minus taxes on stocks that become unrestricted, plus the value realized from exercising options, minus the value of the change of the CEO's stock holdings, plus dividend payouts net of taxes. Please see Dittmann and Maug (2007) for more details.

Past Stock Market Performance is the cumulative abnormal stock market performance over the previous quarter. For the CEO-options analysis, which is conducted at the firm-year level, *Past Stock Market Performance* is the cumulative abnormal stock market performance over the previous year. We compute abnormal stock market performance as the difference between the raw stock returns minus the stock returns on a value-weighted portfolio of firms with a similar size, book-to-market ratio, and past returns (Daniel *et al.*, 1997). *ROA* is a firm's net income as of the most recent fiscal year end, divided by its lagged book value of assets.

RESULTS

Table 1 reports a correlation matrix and descriptive statistics for our sample. Note that in Columns 1 to 3, observations are at the firm/year-month level. In Columns 4 to 17, observations are at the firm/year level.

While our sample includes multiple observations per firm, because founder CEO status is essentially time-invariant at the firm level, a firm-fixed effects model is not suitable.⁸ Specifically, we find that in our sample, there is only one instance in which the firm is initially managed by a professional CEO and where the founder CEO returns and replaces the professional CEO. Vice versa, in our Twitter sample, no founder-CEO-managed firm is subsequently managed by a professional CEO. In our conference call-, earnings forecast- and options samples, of the firms that are founder-CEO managed, only 2, 7 and 18 firms experience a replacement by a professional CEO.

⁸ Fixed effect estimation requires significant within panel variation of the variable values to produce consistent and efficient estimates (Wooldridge, 2002). While founder CEO status is essentially time-invariant at the firm level, we do find two founder CEOs who later become executives at firms managed by a professional CEO. We observe no significant change in their option exercise behavior, suggesting that their level of overconfidence is person-specific rather than firm-specific and that what we are capturing is a person-specific trait rather than a firm-level characteristic. Unfortunately, our sample is extremely small and we are unable to draw strong inferences.

In our analyses, we therefore estimate random effects Generalized Least Square (GLS) models with clustered standard errors. These models are robust to first order autoregressive disturbances within unbalanced-panels and to cross-sectional correlation and heteroskedasticity across panels (Baltagi, 2008). Table 2 presents the results from our main regression equation:

$$(1) Y_{i,t} = \alpha + \beta Founder CEO_i + X\delta + \varepsilon_{i,t}.$$

The dependent variable, $Y_{i,t}$, is one of our four measures of overconfidence: *Neg. Tweets*, *Neg. Calls*, *Misguidance*, and *Options*. Our key independent variable is *Founder CEO*, which equals one for founder CEOs and zero for professional CEOs. Following prior studies on managerial overconfidence, we include various controls (X), all of which are described above. X also contains year-month fixed effects for regression based on *Neg. Tweets*, *Neg. Calls*, and *Misguidance*, and year fixed effects for the regression based on *Options*.

The regression results show when the dependent variable is *Neg. Tweets*, the coefficient estimate on *Founder CEO* equals -0.011 (p -value < 0.01). When the dependent variable is *Neg. Calls*, the coefficient estimate on *Founder CEO* equals -0.001 (p -value < 0.01). These estimates suggest that founder CEOs use fewer negative words in communicating about their firms than professional CEOs and that these differences can be explained neither by CEO- and firm characteristics nor by measures of firm performance.

To put these coefficient estimates in perspective, the average fraction of negative words used by CEOs in their tweets is 1.15%. Our regression analysis implies that, all else equal, the fraction of negative words used by founder CEOs is 1.08% lower than that of professional CEOs. Correspondingly, the average fraction of negative words used by CEOs during earnings conference calls is 0.94%. Our regression implies that, all else equal, the difference in the fraction of negative words used by founder CEOs versus professional CEOs is -0.10%. Compared with the unconditional means, these differences are very meaningful.

Both *Neg. Tweets* and *Neg. Calls* are expressed in fractions and, as a result, may suffer from zero-inflation. In untabulated analyses, we assess the robustness of our findings to zero-inflation by estimating fractional response regression models (Papke and Wooldridge, 1996). In short, our results are robust to this model specification (results are available upon request).

In the interest of symmetry, we also experiment with the fraction of positive words. Prior literature finds little value in positive word lists (e.g., Engelberg, 2008; Kothari, Li, and Short, 2008; Loughran and McDonald, 2011; Tetlock, 2007). The reason is that the use of positive words in the English language is highly nuanced and parsing programs, which rely on simple word lists, are unable to differentiate statements such as “we are profitable” [positive] from statements such as “we could be more profitable” [negative]. Negative words such as “delayed” or “discredited” have a much more pervasive effect as, irrespective of the sentence structure, these words generally convey negative sentiment (“we are delayed” versus “we could be more delayed”).

As negated positive words are frequently used as euphemisms for bad states (e.g., “not good” in lieu of “bad”), we do not count positive words that are negated; negation is defined to be an occurrence of one of six words (no, not, none, neither, never, nobody) within three words preceding a positive word (Loughran and McDonald, 2011). *Pos. Tweets* and *Pos. Calls* then are the fraction of non-negated positive words in CEO tweets and CEO statements during earnings conference calls, respectively. In short and, in some regard, consistent with prior literature, we find no reliable difference in the use of positive words between founder CEOs and professional CEOs.

Table 2 also reports results for the earnings guidance- and the options analysis. We find that when the dependent variable is *Misguidance*, the coefficient estimate on *Founder CEO* equals 0.003 (p -value < 0.05). The average *Misguidance* in our sample is -0.001. That is,

consistent with prior literature, the average management earnings forecast is too “pessimistic” and it is generally beaten by actual earnings. Our regression analysis suggests that, all else equal, the price-scaled quarterly EPS forecast issued by founder CEOs is 0.003 higher than that of professional CEOs, which is economically meaningful. When the dependent variable is *Options*, the coefficient estimate on *Founder CEO* equals 0.470 (p -value < 0.01), which suggests that the ratio of the value of a CEO’s vested in-the-money options to his/her total compensation is, on average, 47.0% higher for founder CEOs than for professional CEOs. Given that the average ratio in our sample is 45.8%, the difference of 47.0% is substantial.⁹

Overall, our results are consistent with the hypothesis that, *ceteris paribus*, founder CEOs are more overconfident than professional CEOs. The implied differences in overconfidence between founder CEOs and professional CEOs are statistically significant and economically meaningful.

***** Insert Tables 1 and 2 about here *****

ADDITIONAL ANALYSES

Option exercise behavior of executives working at founder firms

Our analysis raises the question of whether the overconfidence level of other executives in founder-CEO-managed firms is similarly high. For convenience, we hereafter refer to “non-CEO executives” as “executives” and to “founder-CEO-managed firms” as “founder firms”.

On the one hand, executives in founder firms have been part of the success story and they have beaten extreme odds working alongside the founder CEO. Furthermore, founder CEOs

⁹ To check whether our results are driven by outliers of the *Options* variable, we compare the *Options* variable’s distribution across founder CEOs and professional CEOs. We find that our main results come from a shift in distribution, not from outliers. This pattern holds when we match each founder CEO observation with a professional CEO observation based on CEO characteristics, such as CEO tenure. We also run a sub-sample regression analysis by dropping “outliers” (observations that are above and below two standard deviations of the mean) and we still find support for our hypothesis. All results are available upon request.

may hire executives who share a similar level of “enthusiasm” (overconfidence). Hence, executives in founder firms may be just as overconfident as the founder CEO.

On the other hand, many executives in founder firms are perhaps better described as “mid stage employees” and, thus, mimic more the traits of professional employees than those of entrepreneurs. Also, founder CEOs receive the bulk of the praise from the media. Viewed from this angle, executives in founder firms should be less overconfident than founder CEOs.

To examine this question, we compare the overconfidence level of founder CEOs to that of executives in founder firms. We also conduct comparisons with professional CEOs and executives in non-founder firms.

The number of executives working at founder firms where the founder CEO has an active Twitter account and the executives themselves also tweet actively is very small. Executives other than the CFO rarely speak up during earnings conference calls. Management earnings forecasts are issued at the firm level. Given these various data constraints, we conduct our additional test using options data only. Specifically, we extend our options dataset to include all CEOs and executives working for S&P 1500 firms. Our sample contains 8,026 CEOs and executives working for 1,238 different firms. We create two categorical variables in addition to *Founder CEO*: *Founder-Firm-Exec*, which equals one for executives of founder firms, and zero otherwise. *Professional-Firm-Exec*, which equals one for executives of professional-CEO-managed firms, and zero otherwise. The baseline category is that of professional CEO. Otherwise, the regression equation is very similar to equation (1), but we now no longer control for executive tenure as for most non-CEO executives the data reporting when the executive joined the firm is missing. Table 3 reports our findings. Model 1 includes all CEOs and executives working for S&P 1500 firms. The coefficient estimate on *Founder CEO* is 0.674 (p -value < 0.01), confirming our main prediction that founder CEOs are more overconfident than

professional CEOs. The coefficient estimate on *Founder-Firm-Exec* is positive but insignificant. The coefficient estimate on *Professional-Firm-Exec* is -0.173 (p -value <0.01).

When we perform a Wald test, we find that the coefficient estimate on *Founder CEO* is significantly greater than that on *Founder-Firm-Exec*, suggesting that founder CEOs are more overconfident than executives working at founder firms, a finding that is confirmed by Model 2, which performs a subsample analysis using founder firms only. At the same time, a Wald test comparing the estimate on *Founder-Firm-Exec* with that on *Professional-Firm-Exec* reveals that executives working at founder firms are more overconfident than executives working at non-founder firms. This result is in line with the intuition outlined above that some executives have been part of the success story working alongside the founder CEO and that founder CEOs, through homophily, attract like-minded kinds. In the end, our “overconfidence ranking” is as follows: Founder CEOs >> executives working at founder firms \approx professional CEOs >> executives working at firms managed by professional CEOs, whereby “>>” denotes differences that are statistically significant at the 1% level.

***** Insert Table 3 about here *****

We are mindful of the possibility that founder CEOs and their executives hold on to “too many” options simply because they have more positive inside information. Malmendier and Tate (2005) examine the possibility that their options-based measure of overconfidence proxies for positive inside information. They point to the fact that, in the data, options-based overconfidence is very persistent. Positive information, on the other hand, should be transitory. Malmendier and Tate also find that their options-based measure does not predict performance.

Motivated by Malmendier and Tate (2005), we estimate a regression of a firm’s one-year stock return on lagged values of *Options*, past one-year stock-market performance, past book-to-market ratio and market capitalization, the latter three of which have been found to capture most

of the variation in average stock returns (Daniel *et al.*, 1997; Fama and French, 1992).¹⁰ The estimate on *Options* is -0.013 (p -value < 0.10). That is, high overconfidence mildly predicts *more negative* stock returns, which contrasts with the positive inside information view.

Entrepreneurial optimism discount

The results from our previous analysis suggest that founder CEOs' tweets are more clouded by overconfidence and perhaps more biased and less informative than professional CEOs' tweets. We thus may expect the association between the tone of CEOs' tweets and their firms' future stock market performance to be weaker for founder CEOs than for professional CEOs, as investors discount founder-CEO tweets.

To assess the possibility of an “entrepreneurial optimism discount”, in our final analysis, we test for differences in investor responses between founder CEOs and professional CEOs. We follow Chen, Hwang, and Liu (2014), who test how CEO Twitter accounts affect the information environment of the firm, and estimate the following regression equation:

$$(2) ARet_{i,t+2} = \alpha + \beta Neg. Tweets_{i,t} + X\delta + \varepsilon_{i,t}.$$

$ARet_{i,t+2}$ is a measure of abnormal stock market performance, where i indexes firms and t denotes the day on which tweets are posted. Abnormal returns are the difference between the raw returns minus the returns on a value-weighted portfolio of firms with a similar size, book-to-market ratio, and past returns (Daniel *et al.*, 1997). By testing whether the tone in tweets *predicts* future one-day stock market performance, rather than contemporaneously correlates with stock prices, we follow the approach used in the literature. (Tetlock *et al.*, 2008, p.1452) provides a discussion of this approach.

¹⁰ Our relatively short sample period of five years (and the associated lack of power) complicates the assessment of whether *Options* is persistent in our sample. Given that Malmendier and Tate (2005) provide strong evidence of persistence of their options-based measure, our measure, which is similar to that of Malmendier and Tate, is likely to be persistent as well.

To ensure that information transmitted through tweets is distinct from news announcements and investor opinions on social media, we control for information transmitted through a major news aggregator and a financial opinion aggregator, respectively: Dow Jones News Service (DJNS) and Seeking Alpha (SA). *Neg. DJNS* and *Neg. SA* are the average fraction of negative words across all articles published in the DJNS and SA about the focal company. *Neg. SA-Comment* is the average fraction of negative words across SA comments posted over days t to $t+1$ in response to the SA articles. $I(DJNS)$, $I(SA)$, and $I(SA-Comment)$ are indicator variables denoting whether there were articles published in the DJNS and SA, and whether there were any comments posted in response to SA articles. *Upgrade* and *Downgrade* reflect recommendation upgrades/downgrades for the focal company from the IBES recommendation file. Other control variables are as before.

Table 4 reports our findings. The coefficient estimate on *Neg. Tweets* is -0.015 (p -value < 0.05), suggesting that future abnormal returns are approximately 0.05% lower when the fraction of negative words in tweets is one standard deviation higher. Thus, investors do appear to react to CEOs' tweets and, specifically, to the tone of their tweets. When we include *Founder CEO* and *Neg. Tweets * Founder CEO* as additional independent variables, the coefficient estimate on *Founder CEO* is 0.001 (p -value > 0.10) and the coefficient estimate on the interaction terms is -0.016 (p -value > 0.10). These results suggest that investors are unaware of any incremental bias in founder-CEO tweets.

***** Insert Table 4 about here *****

DISCUSSION AND CONCLUSION

Given their economic significance, a vast body of work studies large publicly traded companies and aims to understand differences in behavior and performance between those managed by founder CEOs and those managed by professional CEOs (e.g., Certo *et al.*, 2001; Fahlenbrach,

2009; Jayaraman *et al.*, 2000; Nelson, 2003; Villalonga and Amit, 2006). However, we know relatively little about the source that generates the aforementioned differences.

In this study, we theorize that one important source is the different level of overconfidence between the two types of CEOs. We hypothesize that founder CEOs are more overconfident than their professional counterparts. We find support for our arguments using the following four proxies for overconfidence: (a) CEO tweets, (b) CEO statements made during earnings conference calls, (c) management earnings forecasts, and (d) the degree to which the CEO exercises his/her exercisable in-the-money options.

Consistent with our argument, we find that founder CEOs use substantially fewer negative words than professional CEOs. This pattern is observed for both CEOs' (a) personal tweets and (b) statements made during earnings conference calls. We also find that (c) founder CEOs tend to provide more optimistic earnings forecasts. Finally, in our analysis of CEO option-exercise behavior, we find that (d) founder CEOs are much more likely to hold on to an unreasonably high number of options than professional CEOs.

In a separate test, we provide evidence that founder CEOs are more overconfident than other executives working at their own firm. In addition, we find that executives working at founder firms are more overconfident than executives working at non-founder firms, suggesting that the overconfidence level of founder CEOs spills over to key employees. The spillover effect could be due to key employees becoming overconfident as they (together with the founder CEO) successfully turn the start-up into a large publicly traded company and/or due to founder CEOs attracting like-minded kinds.

Finally, we provide evidence that, to date, investors are unaware of the overconfidence bias among founders and that they, instead, take founder CEOs' statements at face value, suggesting that an entrepreneurial optimism discount does not exist in the stock market.

Our study makes several contributions to the management and finance literature. First, we add to the literature on differences in the behavior and performance of large founder-CEO-managed firms and large professional-CEO-managed firms (e.g., Certo *et al.*, 2001; Fahlenbrach, 2009; Jayaraman *et al.*, 2000; Nelson, 2003; Villalonga and Amit, 2006). We theorize and identify one key characteristic along which captains of the largest and, economically-speaking, most significant organizations differ.

Second, we add to the literature on managerial overconfidence (e.g., Galasso and Simcoe, 2011; Hayward and Hambrick, 1997; Malmendier and Tate, 2005, 2008; Roll, 1986), which builds on the notion that some CEOs are more overconfident than others and utilizes this variation in overconfidence to study how more (or less) overconfidence translates into different firm outcomes. Our results suggest that differences in overconfidence can be traced, at least partially, to differences in CEO type, i.e., being a founder CEO versus a professional CEO.

Third, we contribute to the emerging literature on an entrepreneurial optimism discount (e.g., Certo *et al.*, 2001; Dushnitsky, 2010). This literature stream posits that sophisticated investors (e.g., investment bankers, venture capitalists) are likely to be aware of an entrepreneurial optimism bias and discount entrepreneurs' intentions and their corresponding firm's market value correspondingly. We test this conjecture by studying the market's reaction to founder CEOs' tweets and professional CEOs' tweets and by searching for a potential difference in investor response. We observe no meaningful difference in market reaction to founder CEOs' tweets versus professional CEOs' tweets, suggesting that, in the stock market, investors do not recognize the stronger bias in founder-CEO tweets.

Villalonga and Amit (2006) find that founder-managed firms have higher firm-valuation ratios than their non-founder-managed counterparts. Our results imply that investors are unaware of the incremental overconfidence among founders and that they, instead, take founder CEOs'

perspective at face value; this lack of awareness may partially contribute to the higher observed firm-valuation ratios for founder-managed firms.

On the methodological front, we point out that overconfidence at the CEO level is not a sufficient condition to explain firm behavior. We propose a set of measures, which, when used jointly, capture overconfidence at the personal level and the group level and can help assess the robustness and validity of the interpretation. Relatedly, we propose a novel setting, CEO tweets, to infer CEO characteristics. We argue that CEO tweets exhibit features (unfiltered, personal, and spontaneous), which are unique and make them attractive for use in future studies, be it on overconfidence or some other personal trait.¹¹

Our findings have practical implications for investors and boards of directors. Our results point to differences in overconfidence by CEO type and investors may decide to discount or surcharge their opinions and predictions accordingly. This is not to say that investors should always/unconditionally discount the value of founder-managed firms, as founders' overconfidence may also have positive effects (Navis and Ozbek, 2015). We merely note the possibility that compared with professional managers, founder CEOs make faster (but less comprehensive) and more risky (but potentially more rewarding) decisions, and they create unrealistic (but perhaps motivating) goals for employees and stakeholders.

For members of the board of directors, our study suggests that when board members decide to release the founder CEO and hire a new professional CEO to work for their company, they should consider differences in behavioral traits. Hiring a professional CEO brings new knowledge, routines, networks, and other resources to a firm but also changes the level of optimism in the firm, which may have a substantial impact on both the firm's strategy and employees' morale.

¹¹ In an attempt to facilitate research on this matter, in our Online Appendix, we make available the full list of CEOs with a personal Twitter account along with their Twitter screenname and other identifying information so that the interested reader may easily download and process these tweets.

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Table 1: Descriptive statistics and correlation matrix

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|----|------------------------------|---------|---------|---------|--------|---------|---------|---------|--------|---------|---------|---------|---------|---------|--------|--------|--------|-------|
| 1 | Neg. Tweets | 1.00 | | | | | | | | | | | | | | | | |
| 2 | Neg. Calls | -0.08 | 1.00 | | | | | | | | | | | | | | | |
| 3 | Misguidance | 0.13 | 0.07 | 1.00 | | | | | | | | | | | | | | |
| 4 | Options | 0.04 | -0.29* | 0.27 | 1.00 | | | | | | | | | | | | | |
| 5 | Founder CEO | -0.06** | -0.06* | 0.04* | 0.12** | 1.00 | | | | | | | | | | | | |
| 6 | Log(Age) | 0.08** | 0.09** | 0.03 | -0.01 | 0.09** | 1.00 | | | | | | | | | | | |
| 7 | Log(Tenure) | 0.18** | 0.05* | -0.00 | 0.21** | 0.37** | 0.33** | 1.00 | | | | | | | | | | |
| 8 | Male | -0.01 | 0.04 | 0.01 | 0.03* | 0.03 | 0.05** | 0.06** | 1.00 | | | | | | | | | |
| 9 | Log(Wealth) | 0.03* | 0.03 | 0.02 | 0.15** | 0.12** | 0.29** | 0.34** | 0.04* | 1.00 | | | | | | | | |
| 10 | Log(Size) | 0.02 | -0.07** | 0.02 | 0.15** | -0.13** | 0.08** | -0.09** | 0.01 | 0.53** | 1.00 | | | | | | | |
| 11 | Monthly Volatility | -0.03* | 0.13** | 0.31** | -0.02 | 0.00 | -0.02 | -0.03 | 0.00 | -0.08** | -0.17** | 1.00 | | | | | | |
| 12 | Institutional Holding | 0.14** | 0.06* | -0.00 | 0.04* | -0.02 | -0.03 | 0.02 | -0.01 | 0.13** | 0.07** | 0.01 | 1.00 | | | | | |
| 13 | Log(Price) | 0.15** | -0.09** | 0.04* | 0.24** | -0.06** | 0.05** | 0.02 | 0.04** | 0.35** | 0.63** | -0.24** | 0.15** | 1.00 | | | | |
| 14 | Earnings Surprise | 0.00 | -0.09** | -0.14** | 0.05** | 0.01 | 0.02 | 0.02 | 0.05** | 0.02 | 0.05** | -0.03 | -0.01 | 0.11** | 1.00 | | | |
| 15 | Aret | 0.00 | -0.13** | -0.04* | 0.11** | -0.01 | -0.02 | -0.02 | 0.01 | -0.04* | -0.13** | 0.10** | -0.05** | -0.19** | 0.01 | 1.00 | | |
| 16 | Log(Market-to-Book) | 0.02 | -0.07** | -0.02 | 0.33** | -0.00 | -0.12** | -0.02 | -0.04* | 0.12** | 0.17** | -0.04* | 0.10** | 0.18** | 0.02 | 0.11** | 1.00 | |
| 17 | ROA | 0.05** | -0.00 | 0.06** | 0.25** | -0.05** | -0.03 | -0.04* | 0.01 | 0.15** | 0.20** | -0.08** | 0.08** | 0.32** | 0.07** | 0.05** | 0.46** | 1.00 |
| | #Obs. | 6,711 | 1,791 | 3,396 | 4,010 | 4,010 | 4,010 | 4,010 | 4,010 | 4,010 | 4,010 | 4,010 | 4,010 | 4,010 | 4,010 | 4,010 | 4,010 | 4,010 |
| | Mean | 0.01 | 0.01 | -0.00 | -0.78 | 0.13 | 4.01 | 1.73 | 0.97 | 9.66 | 7.63 | 0.02 | 0.80 | 3.24 | -0.00 | 0.05 | 0.75 | 0.10 |
| | S.D. | 0.03 | 0.00 | 0.02 | 1.85 | 0.33 | 0.12 | 0.86 | 0.18 | 1.36 | 1.55 | 0.06 | 0.19 | 0.81 | 0.03 | 0.56 | 0.74 | 0.09 |

- Correlation coefficients in Rows 1 to 4 are calculated based on the sample of tweeting CEOs at the firm-year level.
- Other correlation coefficients are calculated based on the following samples: Column 1 – sample of tweeting CEOs; Column 2 – random sample of S&P1500 firms; Columns 3 to 17 – full sample of S&P1500 firms.
- In Columns 1 to 3, observations are at a firm/year-month level. In Columns 4 to 17, observations are at a firm/year level.
- * and ** denote statistical significance at the 5% and 1% levels, respectively.

Table 2: Differences in overconfidence between founder CEOs and professional CEOs

| Dependent variables | <i>Neg. Tweets</i> (1) | <i>Neg. Calls</i> (2) | <i>Misguidance</i> (3) | <i>Options</i> (4) |
|--------------------------------------|------------------------------------|------------------------------------|----------------------------------|-----------------------------------|
| Founder CEO | -0.011*** (0.004) | -0.001*** (0.001) | 0.003** (0.001) | 0.470*** (0.181) |
| <i>Log(CEO Age)</i> | -0.003 (0.009) | 0.003* (0.002) | 0.002 (0.004) | -1.120*** (0.347) |
| <i>Log(Tenure)</i> | 0.008*** (0.002) | 0.000 (0.000) | -0.000 (0.000) | 0.539*** (0.060) |
| <i>Male</i> | 0.001 (0.009) | 0.001 (0.001) | -0.000 (0.001) | 0.137 (0.198) |
| <i>Log(Wealth)</i> | | | | -0.097 (0.096) |
| <i>Log(Size)</i> | 0.001 (0.001) | 0.000 (0.000) | -0.000 (0.000) | 0.096 (0.072) |
| <i>Monthly Volatility</i> | 0.011 (0.016) | 0.003 (0.003) | 0.116*** (0.024) | 0.550 (0.371) |
| <i>Institutional Holding</i> | 0.007* (0.004) | 0.002** (0.001) | -0.001 (0.003) | -0.203 (0.161) |
| <i>Log(Price)</i> | 0.001 (0.001) | -0.000* (0.000) | 0.003** (0.001) | 0.365*** (0.077) |
| <i>I(Earnings Announcement)</i> | -0.005*** (0.001) | | | |
| <i>Earnings Surprise</i> | 0.098 (0.130) | -0.002*** (0.001) | -0.077* (0.041) | 1.379 (1.150) |
| <i>Past Stock Market Performance</i> | 0.012*** (0.004) | -0.002*** (0.000) | 0.000 (0.001) | 0.382* (0.206) |
| <i>Log(Market-to-book)</i> | -0.001 (0.002) | -0.000 (0.000) | -0.001* (0.001) | 0.538*** (0.062) |
| <i>ROA</i> | -0.001 (0.007) | 0.002 (0.002) | 0.012 (0.011) | 1.889*** (0.409) |
| Time fixed effects | Yes | Yes | Yes | Yes |
| # Obs. | 7,686 | 2,033 | 3,776 | 4,010 |
| # CEOs | 71 | 160 | 714 | 1,392 |
| R^2 | 0.081 | 0.164 | 0.150 | 0.219 |

- In Columns (1) to (3), observations are at a firm-year/month level and we include *year-month fixed effects*. In Column (4), observations are at a firm-year level and we include *year fixed effects*. Robust standard errors clustered by CEO are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% or lower levels, respectively.

Table 3: Differences in option exercise behavior between founder CEOs and executives in founder firms

| Dependent variable: Options | All Firms (1) | Founder Firms (2) |
|--------------------------------------|-----------------------------|-----------------------------|
| <i>Founder CEO</i> | 0.674*** (0.150) | |
| <i>Founder-Firm-Exec</i> | 0.099 (0.072) | -0.948*** (0.354) |
| <i>Professional-Firm-Exec</i> | -0.173*** (0.052) | |
| <i>Log(Exec Age)</i> | -0.298** (0.126) | -0.488 (0.368) |
| <i>Male</i> | 0.202** (0.083) | -1.043*** (0.271) |
| <i>Log(Wealth)</i> | 0.250*** (0.018) | 0.106 (0.107) |
| <i>Log(Size)</i> | -0.121*** (0.017) | -0.000 (0.098) |
| <i>Monthly Volatility</i> | 0.135 (0.173) | 0.511 (1.244) |
| <i>Institutional Holding</i> | -0.453*** (0.072) | -0.715*** (0.203) |
| <i>Log(Price)</i> | 0.455*** (0.032) | 0.399*** (0.104) |
| <i>Earnings Surprise</i> | -0.006 (0.004) | 4.501 (3.072) |
| <i>Past Stock Market Performance</i> | 0.400*** (0.107) | 0.988*** (0.085) |
| <i>Log(Market-to-book)</i> | 0.514*** (0.027) | 0.330*** (0.067) |
| <i>ROA</i> | 1.712*** (0.188) | 0.813** (0.416) |
| Time fixed effects | Yes | Yes |
| # Obs. | 20,043 | 2,524 |
| # Executives | 8,026 | 981 |
| <i>R</i> ² | 0.192 | 0.184 |

- Robust standard errors clustered by executives are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% or lower levels, respectively.

Table 4: Market response to tweets by founder CEOs and professional CEOs

| | (1) | (2) | (3) |
|----------------------------------|----------------------------|----------------------------|--------------------------|
| <i>Neg. Tweets</i> | -0.015** (0.007) | -0.014** (0.007) | -0.011 (0.008) |
| <i>Founder CEO</i> | | 0.001 (0.000) | 0.001 (0.000) |
| <i>Neg. Tweets * Founder CEO</i> | | | -0.016 (0.011) |
| <i>Neg. SA</i> | -0.021 (0.143) | -0.026 (0.139) | -0.027 (0.139) |
| <i>I(SA)</i> | 0.000 (0.003) | 0.000 (0.003) | 0.000 (0.003) |
| <i>Neg. SA-Comment</i> | 0.005 (0.097) | 0.005 (0.097) | 0.005 (0.097) |
| <i>I(SA-Comment_i)</i> | -0.001 (0.003) | -0.001 (0.003) | -0.001 (0.003) |
| <i>Neg. DJNS</i> | -0.093 (0.088) | -0.093 (0.088) | -0.091 (0.088) |
| <i>I(DJNS)</i> | 0.002* (0.001) | 0.002* (0.001) | 0.002* (0.001) |
| <i>Upgrade</i> | 0.002 (0.002) | 0.002 (0.002) | 0.002 (0.002) |
| <i>Downgrade</i> | -0.005* (0.003) | -0.005* (0.003) | -0.005* (0.003) |
| <i>I(Earnings Announcement)</i> | -0.002 (0.002) | -0.002 (0.002) | -0.002 (0.002) |
| <i>Earnings Surprise</i> | -0.237 (0.529) | -0.242 (0.531) | -0.241 (0.530) |
| <i>Monthly Volatility</i> | 0.049 (0.036) | 0.050 (0.036) | 0.050 (0.036) |
| <i>ARet</i> | -0.001 (0.014) | -0.001 (0.014) | -0.001 (0.014) |
| <i>ARet_(t-1)</i> | -0.005 (0.015) | -0.006 (0.015) | -0.006 (0.015) |
| <i>ARet_(t-2)</i> | -0.027 (0.020) | -0.026 (0.020) | -0.027 (0.020) |
| <i>ARet_(t-60,t-3)</i> | -0.004 (0.003) | -0.004 (0.003) | -0.004 (0.003) |
| # Obs. | 7,045 | 7,045 | 7,045 |
| <i>R</i> ² | 0.028 | 0.028 | 0.028 |

- Robust standard errors are clustered by firm and year-month and reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% or lower levels, respectively.