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ARE FOUNDER CEOS MORE OVERCONFIDENT THAN PROFESSIONAL CEOS? EVIDENCE FROM S&P 1500 COMPANIES

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Research summary: *We provide evidence that founder chief executive officers (CEOs) of large S&P 1500 companies are more overconfident than their nonfounder counterparts ("professional CEOs"). We measure overconfidence via tone of CEO tweets, tone of 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 firms to be undervalued, as implied by their option-exercise behavior. We provide evidence that, to date, investors appear unaware of this "overconfidence bias" among founders.*

Managerial summary: *This article helps to explain why firms managed by founder chief executive officers (CEOs) behave differently from those managed by professional CEOs. We study a sample of S&P 1500 firms and find strong evidence that founder CEOs are more overconfident than professional CEOs. To date, investors appear unaware of this overconfidence bias among founders. Our study should help firm stakeholders, including investors, employees, suppliers, and customers, put the statements and actions of founder CEOs in perspective. Our study should also help members of corporate boards make more informed decisions about whether to retain (or bring back) founder CEOs or hire professional CEOs.*

INTRODUCTION

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

These studies point to substantial differences between firms managed by founder CEOs and those managed by professional CEOs. Yet, we

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know relatively little about what attributes of founder CEOs and professional CEOs lead to these differences in the first place.[1] Our purpose in this article 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, or future prospects, and to underestimate risk (Barber and Odean, 2001; Dushnitsky, 2010; Malmendier and Tate, 2005; Simon and Houghton, 2003).

Our suspicion stems from two sources: (1) studies arguing that the average CEO is overconfident, but that there is also considerable 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) studies seeking to explain 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 nonentrepreneurs (e.g., Camerer and Lovallo, 1999; Cooper, Woo, and Dunkelberg, 1988; Lowe and Ziedonis, 2006). Empirical work suggests that, in general, founders of small start-up firms are more overconfident than professional managers.[3] Busenitz and Barney (1997) explore differences in cognitive biases between founders and/or entrepreneurs in (small) start-up firms and executives in large organizations. Using survey data from 219 entrepreneurs and professional managers, Busenitz and Barney find that entrepreneurs exhibit significantly greater confidence than professional managers. Forbes (2005) uses survey data on 108 entrepreneurs and nonfounding managers of new venture firms to show that founder-managers are more confident than professional managers working for companies in the entrepreneurial stage.

These studies help us understand the behavior of founder CEOs in small start-up companies. However, whether the observations made for small start-up companies easily extrapolate to large publicly traded companies is unclear (Wasserman, 2003). In particular, previous studies on corporate life cycles find that the characteristics required of successful CEOs in new startups are significantly different from the characteristics required of successful CEOs in large organizations (Boeker and Karichalil, 2002; Hambrick and Crozier, 1986). Founder CEOs who fail to adapt to becoming managers of large organizations or fail, in some regard, to become more like professional CEOs, may therefore find themselves being replaced.

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

Our sample contains data on S&P 1500 companies for the period running from 2008 through 2012. Our proxies for overconfidence are as follows: (1) tone of CEO tweets, (2) tone of statements made by CEOs during earnings conference calls, (3) top management predictions of a company's future earnings ("management earnings forecasts"), and (4) the degree to which a CEO exercises his or her exercisable in-the-money options.

In our first test, we build on findings from prior literature indicating 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 examines CEO statements during earnings conference calls. These differences in tone do not appear to be driven by differences in firm performance.

[1]Recently, scholars have begun focusing on the sources of differences between founder CEOs and professional CEOs (e.g., Certo *et al.*, 2001; Fahlenbrach, 2009; Nelson, 2003; Villalonga and Amit, 2006, 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 "babies or legacies," and their attitudes toward risk differ from those of professional CEOs. Founder CEOs are also often more knowledgeable about their firms and are better networked with their employees. However, empirical evidence pertaining to these differences is scarce, leaving the door open for future research.

[2]Large bodies of literature exist on overconfidence (e.g., Hayward and Hambrick, 1997; Malmendier and Tate, 2005; Navis and Ozbek, 2016; 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.

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

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Our third test builds on prior studies that suggest that firm management has strong incentives to lower investors' earnings expectations prior to earnings announcements to make it easier for a 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 option grants as part of their compensation. As CEOs' fortunes are intimately linked to those of 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 firms' future returns (Malmendier and Tate, 2005). Our analysis suggests that founder CEOs hold on to options to a greater degree than professional CEOs. 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 firms managed by professional CEOs. We discuss potential explanations for these differences later in the article.

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 to the tone of tweets by founder CEOs in the same way as they do to tweets by professional CEOs despite our evidence that tweets by founder CEOs are generally much more positive and that this difference in tone cannot be explained by firm performance.

In sum, our study contributes 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.

Given the significance of founder-managed firms to the overall economy, a large body of work has begun to examine the behavior of founder-managed firms and contrast it to that of firms managed by professional CEOs. The literature finds that firms managed by founder CEOs engage in more merger and acquisition (M&A) activities and invest more heavily in capital expenditures and (risky) R&D (Fahlenbrach, 2009). Founder-managed firms also trade at higher valuation ratios (Villalonga and Amit, 2006). While the observed differences are strong and statistically reliable, the exact economic mechanisms that underlie these aforementioned differences remain unclear. Our study helps to fill this gap: Our evidence that founder CEOs are systematically more overconfident than professional CEOs helps, in part, to explain the observed difference in investment behavior. By providing evidence that investors are as yet unaware of this particular overconfidence bias, our findings also help explain why firms managed by founder CEOs trade at substantially higher valuation ratios than their counterparts managed by professional CEOs.

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 degree of uncertainty pertaining to their abilities correctly. Svenson (1981) reports that the vast majority of subjects in his study of automobile drivers regard themselves as more skillful and less risky than the average driver.

Top management executives are known to be particularly vulnerable to overconfidence bias, as overconfidence is stronger among highly skilled individuals than among less skilled individuals (Camerer and Lovallo, 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 as well as higher-stake strategic actions.

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Complementing such theoretical work on managerial overconfidence, Malmendier and Tate (2008) develop options-based proxies for CEO overconfidence and provide evidence that more overconfident CEOs tend to overestimate their ability to generate returns and are more likely to overpay for target companies and undertake value-destroying M&As.

On a more positive note, Hirshleifer *et al.* (2012) suggest that firms with more overconfident CEOs invest more heavily in innovation, obtain more patents, and achieve greater innovative success than other firms. Galasso and Simcoe (2011) also find a positive association between proxies of overconfidence and innovative behavior.

The aforementioned literature finds substantial variation in overconfidence levels and provides evidence that such variation captures differences in firm behavior, such as M&A activity and R&D intensity. But what is the cause of this variation in CEO overconfidence? Which managers are most likely to be overconfident?

Founder CEOs in entrepreneurial firms versus professional CEOs

A large body of research investigates overconfidence bias among entrepreneurs. While many people participate in start-up activities every year, few ventures succeed, and most fail within a few years (Cooper *et al.*, 1988). Scholars attribute this phenomenon to overconfidence bias (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 while underestimating the degree 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 ventures to greatly exceed those of similar startups. Similarly, Camerer and Lovallo (1999) use experiments to study entrepreneurial decision-making regarding 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 because participants overestimate the prospects for success for their *own* particular ventures.

The abovementioned literature does not suggest that entrepreneurs have a higher tolerance for risk (e.g., Brockhaus, 1982; Kahneman and Lovallo, 1993). Instead, entrepreneurs have biased beliefs and overestimate their own odds of success while underestimating the amount of risk involved (Busenitz and Barney, 1997). In other words, it is not the risk-taking propensity of entrepreneurs per se, but the misunderstanding of the true probability distribution that, in the end, makes entrepreneurs take on greater 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" that requires professional CEOs to become more rational, conservative, and realistic (e.g., Busenitz and Barney, 1997; Pfeffer and Lammerding, 1981). Employees who fail to learn and adapt to the needs and norms that large organizations require (e.g., professionalism, conservatism) are often eliminated by the internal selection process (Schneider, 1987; Tsui, Egan, and O'Reilly, 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

The aforementioned evidence, while suggestive, does not justify strong statements regarding CEO overconfidence within large organizations. Founder CEOs are often pressured to adjust their approach to become more appropriate for leading large organizations. The corporate life cycle literature suggests that, as new startups grow significantly, managerial styles and CEO capabilities 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, 1985). Making the transition to large public corporations requires new tasks of CEOs resulting from changes in ownership and governance structures, increased market monitoring, and pressure to meet analyst expectations (Jain and Tabak, 2008). Thus, the attributes that large companies require of their

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CEOs (e.g., management skills, the ability to meeting investor needs, rational decision-making) differ significantly from those that new startups require of their CEOs (e.g., entrepreneurial passion, being visionary, willingness to take risks) (Boeker and Wiltbank, 2005; Wasserman, 2012). Founder CEOs who fail to adapt to the new needs and conditions that large organizations require are often replaced by professional CEOs (Boeker and Fleming, 2010). Viewed from this angle, one could argue that founder CEOs in large organizations often learn to think and behave more like professional CEOs who make more rational, realistic, and logical decisions.

The counterargument, namely, that founder CEOs remain overconfident even as their startups become large publicly traded firms, can be found in the literature on entrepreneurial optimism, which suggests that founder CEOs' overconfidence stems largely from an inherent disposition (e.g., Hmieleski and Baron, 2009; Lowe and Ziedonis, 2006), which makes it difficult for them to reduce their overconfidence even as they become leaders of large organizations. De Meza and Southey (1996) argue, for example, that entrepreneurs are born overconfident and have unrealistic expectations by nature. Hayward, Shepherd, and Griffin (2006) and McCarthy, Schoorman, and Cooper (1993) suggest that founder CEOs' overconfidence persists over time. Hence, while founder CEOs may alter certain personal attributes following the growth stage of their firms, they are unlikely to materially alter their level of overconfidence, which is spawned by an inherent disposition.

Drawing from the literature on managerial overconfidence, we could even make the argument that founder CEOs become *more* overconfident as their firms develop into large public companies. Founder CEOs spearheading organizations that eventually become large publicly traded companies have beaten extreme odds, insofar 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 Lovallo, 1999). Founder CEOs are likely to attribute much of that success to their own competitive attributes (Hayward and Hambrick, 1997), which can inflate their confidence.

In addition, founder CEOs' biographies are often romanticized as stories of "[underdogs] 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 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 SETTING

To measure overconfidence, we use data on CEOs' Twitter posts, statements made in earnings conference calls, management earnings forecasts, and option-exercise behavior. For our control variables, we use data on financial statements, financial markets, financial analysts, and institutional holdings 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.

We construct these variables for a sample of S&P 1500 firms. Our sample period begins in 2008, when the first tweet was posted on the Twitter account of an S&P 1500 CEO, and ends in 2012.[4]

Dependent variable: measures of overconfidence

Prior literature gauges entrepreneur overconfidence at the personal level through surveys and direct questioning of entrepreneurs themselves. 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

[4]As we describe later, we compile a list of all CEOs who are in our various samples, and through a very labor-intensive process, determine, for each CEO, whether he or she is a founder CEO. We note that data on CEO earnings conference call statements, management earnings forecasts, and CEO options are all available for the pre-2008 period. We believe that examining whether our observations, which are made for the 2008 through 2012 period, are weaker or stronger in the pre-2008 period represents an interesting avenue for future research. We would be happy to share our founder data to facilitate research on this matter (please contact the corresponding author).

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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, might 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 overconfidence at both the personal level and the group level. Utilizing the full set of measures helps to alleviate concern about omitted variable bias and strengthens the argument that it is truly overconfidence that is causing the observed differences in firm behavior and performance.[5]

To briefly overview each of our proxies and to contrast them to each other:

(1) 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 October 29, 2009). However, they can also reflect personal moods and views with no direct bearing on a 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 March 20, 2012). As such, CEO tweets likely capture how CEOs feel about their businesses; they also capture how they feel about their lives generally. How CEOs feel about their lives can, in turn, indirectly yet importantly affect a firm's investment and financing decisions (e.g., Cain and McKeon, 2016; 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.
(2) Compared with CEO tweets, CEO statements made during earnings conference calls are more likely to be prepared and/or well reflected on. They are also likely to be influenced by other parties such as an auditor and an investor relations firm.
(3) Management earnings forecasts are also well reflected on and reflect a more conscious form of confidence that is directly pertinent to a given firm. They are also made in conjunction with other parties and allow us to capture the degree to which 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.
(4) Overconfidence inferred via CEO option-exercise behavior reflects *personal* confidence that is directly pertinent to a firm. Given that option-exercise behavior has important implications for a CEO's personal wealth, it is likely well reflected on. An important restriction is that the decision to exercise an option is codetermined by a host of factors such as tax and liquidity considerations (i.e., how much cash a 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 or her network of followers. These short messages are referred to as microblogs, or more commonly, "tweets."

We start with the complete list of CEOs that is in the Execucomp database[6] (as of the time of the download)[7] and locate users with active Twitter

[5]Our article 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 and/or spontaneous forms of overconfidence, which are difficult to capture in survey responses.

[6]The Execucomp database compiles information on the compensation packages of all S&P 1500 executives from the corresponding firms' annual financial statements.

[7]Time of download: February 2014.

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accounts who have the same first and last names as the CEOs in question. We then cross-check each 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 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 Twitter 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 a greater number of 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.[8]

Our first measure of CEO confidence is a continuous variable that equals the average fraction of negative words used across all tweets posted by a given CEO in a day, *Negative tweets*. The observations are on the firm-day level. A lack of negative words indicates that the CEO is confident. Therefore, the lower the value for *Negative 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 in which they discuss their firm's quarterly earnings. Processing all quarterly earnings conference calls for all S&P 1500 firms is very costly. We therefore construct a random subsample via stratified random sampling of all S&P 1500 firms over our 2008–2012 sample period based on industry with a sampling fraction of 10 percent. 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 a given CEO during the conference call discussing quarterly earnings, *Negative calls*. The observations are on the firm-month level. Again, the lower the value of *Negative calls* is, the more confident we deem the CEO to be.

Management earnings forecasts

Management sometimes issues predictions for firms' upcoming earnings announcements, and both investors and sell-side analysts pay close attention to such 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 likelihood of negative earnings surprises (e.g., Bergman and Roychowdhury, 2008; Matsumoto, 2002).

Given that managers have an incentive to issue earnings forecasts that are 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, which compiles data on management earnings forecasts. Our third measure of CEO overconfidence, *Misguidance,* is a continuous variable that equals the difference between forecasted quarterly earnings-per-share (EPS) and actual quarterly EPS, scaled by lagged price-per-share. The observations are on the firm-month level. Our final sample contains 714 CEOs from all 652 S&P 1500 firms that provide earnings guidance during our 2008–2012 sample period as per the FirstCall database.

[8]The full word list can be seen at: http://www.nd.edu/~mcdonald/Word_Lists.html

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CEO options

Our final measure of CEO overconfidence draws on 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 for which they work, 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 then no longer tied to the success or failure of the firm in question (e.g., Hall and Murphy, 2002; Lambert, Larcker, and Verrecchia, 1991). A CEO who delays the exercise of his or her options is likely overly optimistic and overconfident about the firm's prospects (e.g., Li, 2008; Malmendier and Tate, 2005, 2008; Schrand and Zechman, 2012).

Our data source for this variable is the Execucomp database. We follow Dezsö and Ross (2012), and construct the natural log transformation of the ratio of a given CEO's vested in-the-money option value to the CEO's total compensation value (all by fiscal year), *Options*.[9] The observations are on the firm-year level. In total, we have 1,392 CEOs from all 1,238 S&P 1500 firms that have the data to perform our regression analysis over our 2008–2012 sample period.

Independent variable: founder CEO versus professional CEO

To determine whether a CEO is the founder or cofounder 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 cofounders. 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 and/or cofounders for the company in question. Third, we seek out the CEO's profile page on Bloomberg Businessweek, Forbes, and Wikipedia websites. 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, 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 pertinent 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 a given 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 or 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 or her previously received cash inflows is that of a typical savings account.[10]

[9]Specifically, we use Execucomp's TDC1 field. Using TCC, which is a variant of total compensation, does not alter our findings. In untabulated analyses, we follow Schrand and Zechman (2012), and we compute, for each firm-year, the natural logarithm of the value of each CEO's unexercised in-the-money options. If the natural logarithm is above the three-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 those presented in this study (the results are available on request).

[10]Specifically, a CEO's cash inflow in a given year is the sum of his or her 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 any change in the CEO's stock holdings, plus

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Firm-specific control variables

We use data on financial statements, financial markets, financial analysts, and institutional holdings 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 the market value of a firm's equity as of the month prior to the month of the explained variable's measurement. *Market-to-book* is the market value of a firm's assets divided by the book value of its 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 the fraction of a firm's 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 earnings-per-share (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 an earnings announcement in which the earnings surprise was truly zero.

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 raw stock returns and stock returns on a value-weighted portfolio of similar-size firms with similar book-to-market ratios and past returns (Daniel *et al.*, 1997). *ROA* is a firm's net income as of the most recent fiscal year end, divided by the lagged book value of its assets.

dividend payouts net of taxes. Please see Dittmann and Maug (2007) for more details.

RESULTS

Table 1 reports a correlation matrix and descriptive statistics for our sample. Perhaps the most revealing figure from Table 1 is that 13 percent of the firms in our sample are managed by founder CEOs, further cementing the view that founder-managed firms are an economically important component of the U.S. economy.

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 for our purposes.[11] Specifically, we find that, in our sample, there is only one instance in which a firm is initially managed by a professional CEO after which the founder CEO returns and replaces the professional CEO. Conversely, 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, we find that of the firms that are founder-CEO managed, only 2, 7, and 18 firms, respectively, experience a replacement by a professional CEO.

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:

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

The dependent variable, $Y_{i,t}$, is one of our four measures of overconfidence: *Negative tweets*, *Negative calls*, *Misguidance*, and *Options*. Our key independent variable is *Founder CEO*, which equals one for founder CEOs and zero for professional CEOs.

[11] 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 professional CEOs. 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.

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 Negative tweets	1.00																
2 Negative 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 Past stock market performance	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
#Observations	7,686	2,033	3,776	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
SD	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

In Rows 1–4, correlation coefficients are calculated based on the subsample of observations that have realizations for all of our four overconfidence measures. The variables are constructed to be at the firm-year level (if the original variable is measured at a higher frequency; we average realizations to the firm-year level).
In Rows 5–17, correlation coefficients are calculated based on the following samples: Column (1)—sample of tweeting CEOs; Column (2)—random sample of S&P 1500 firms; Column (3)—sample of firms providing earnings guidance; Column (4)—full sample of S&P 1500 firms. In Column (1), observations are at the firm-day level. In Columns (2)–(3), observations are at the firm-month level. In Columns (4)–(17), observations are at the firm-year level.
* and ** denote statistical significance at the 5% and 1% levels, respectively.

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

Dependent variables	*Negative tweets* (1)	*Negative calls* (2)	*Misguidance* (3)	*Options* (4)
Founder CEO	−0.011***	−0.001***	0.003**	0.470***
	(0.004)	(0.001)	(0.001)	(0.181)
Log(CEO age)	−0.003	0.003*	0.002	−1.120***
	(0.009)	(0.002)	(0.004)	(0.347)
Log(tenure)	0.008***	0.000	−0.000	0.539***
	(0.002)	(0.000)	(0.000)	(0.060)
Male	0.001	0.001	−0.000	0.137
	(0.009)	(0.001)	(0.001)	(0.198)
Log(wealth)				−0.097
				(0.096)
Log(size)	0.001	0.000	−0.000	0.096
	(0.001)	(0.000)	(0.000)	(0.072)
Monthly volatility	0.011	0.003	0.116***	0.550
	(0.016)	(0.003)	(0.024)	(0.371)
Institutional holding	0.007*	0.002**	−0.001	−0.203
	(0.004)	(0.001)	(0.003)	(0.161)
Log(price)	0.001	−0.000*	0.003**	0.365***
	(0.001)	(0.000)	(0.001)	(0.077)
I(earnings announcement)	−0.005***			
	(0.001)			
Earnings surprise	0.098	−0.002***	−0.077*	1.379
	(0.130)	(0.001)	(0.041)	(1.150)
Past stock market performance	0.012***	−0.002***	0.000	0.382*
	(0.004)	(0.000)	(0.001)	(0.206)
Log(market-to-book)	−0.001	−0.000	−0.001*	0.538***
	(0.002)	(0.000)	(0.001)	(0.062)
ROA	−0.001	0.002	0.012	1.889***
	(0.007)	(0.002)	(0.011)	(0.409)
Time fixed effects	Yes	Yes	Yes	Yes
# Observations	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 Column (1), observations are at the firm-day level, and we include *year-month fixed effects*.
In Columns (2)–(3), observations are at the firm-month level, and we include *year-month fixed effects*.
In Column (4), observations are at the firm-year level, and we include *year fixed effects*.
Robust standard errors are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% or lower levels, respectively.

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 regressions based on *Negative tweets*, *Negative calls,* and *Misguidance*, and year fixed effects for the regression based on *Options*.

The regression results show when the dependent variable is *Negative tweets*, the coefficient estimate for *Founder CEO* equals −0.011 (p-value < 0.01). When the dependent variable is *Negative calls*, the coefficient estimate for *Founder CEO* equals -0.001 (p-value < 0.01). These estimates suggest that founder CEOs use fewer negative words than professional CEOs and that these differences can be explained neither by CEO or firm characteristics (other than founder status), nor by measures of firm performance.

To put these coefficient estimates in perspective, our regression analysis indicates that, all else remaining equal, the fraction of negative words used by founder CEOs is 1.08 percent lower than that of professional CEOs. Specifically, the fraction of negative words used by professional CEOs is 1.32 percent, whereas that of founder CEOs is 0.24 percent. Given that the average tweet of a professional CEO (founder CEO) contains 15.8 (15.6) words, these numbers imply that, across 1,000 tweets, professional CEOs use 208 negative words, whereas founder CEOs only use 37 negative words.

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Correspondingly, our regression on the earnings conference call sample indicates that, all else remaining equal, the difference in the fraction of negative words used by professional CEOs versus founder CEOs is 0.13 percent (1.60% versus 1.47%). Given that the average professional CEO's (founder CEO's) earnings conference call statement contains 3,491 (3,102) words, our regression analysis indicates that, in a given earnings conference call, professional CEOs use 56 negative words, whereas founder CEOs only use 46 negative words. The difference in the use of negative words is smaller for earnings conference calls than for tweets. One potential explanation is that the former is more likely to be scripted and/or well reflected on as well as influenced by other parties such as an auditor or an investor relations company. Tweets therefore provide a more powerful measure of the corresponding CEO's behavioral traits.

Both *Negative tweets* and *Negative 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 (the results are available on 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) because 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 sentiments ("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 as an occurrence of one of six words (*no*, *not*, *none*, *neither*, *never*, *nobody*) within three words preceding a positive word (Loughran and McDonald, 2011). *Positive tweets* and *Positive calls* then are the fractions of non-negated positive words in CEO tweets and CEO statements made during earnings conference calls, respectively. In short and in a way 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-exercise analyses. We find that when the dependent variable is *Misguidance,* the coefficient estimate for *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 is generally beaten by actual earnings. Our regression analysis suggests that, all else remaining 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 for *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 or her total compensation is, on average, 47.0 percent higher for founder CEOs than for professional CEOs. Given that the average ratio in our sample is 45.8 percent, the difference of 47.0 percent is substantial.[12]

Overall, our results are consistent with the hypothesis that, all else remaining equal, 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.

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

[12]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 are due to a shift in distribution, not 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 subsample 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 on request.

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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 their firms' (and founders') success stories, and have beaten extreme odds working alongside founder CEOs. Furthermore, it seems reasonable to expect that founder CEOs hire executives who share a similar level of what we are measuring as overconfidence. Viewed from this angle, executives in founder firms may be just as overconfident as founder CEOs.

On the other hand, executives in founder firms are perhaps more accurately described as "mid-stage employees," and thus, are more likely to exhibit traits typical of professional employees than those of entrepreneurs. Also, unlike founder CEOs, executives in founder firms receive relatively little praise from the media.

To examine the question of whether the overconfidence level of executives in founder firms is similarly high, we compare the overconfidence level of founder CEOs with that of executives in founder firms. We also conduct comparisons with professional CEOs and executives in nonfounder firms.

The number of executives working at founder firms in which founder CEOs have active Twitter accounts and the executives themselves also tweet actively is very small. Executives other than CFOs 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 over our 2008–2012 sample period. Our sample contains 8,026 CEOs and executives working for 1,238 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; and *Professional-firm-exec*, which equals one for executives of professional-CEO-managed firms and zero otherwise. The baseline category is that of professional CEOs. Otherwise, the regression equation is very similar to Equation 1, but we no longer control for executive tenure since there are few data available indicating when non-CEO executives join their firms.

Table 3 reports our findings. Model 1 includes all CEOs and executives working for S&P 1500 firms. The coefficient estimate for *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 for *Founder-firm-exec* is positive but insignificant. The coefficient estimate for *Professional-firm-exec* is -0.173 (p-value < 0.01).

When we perform a Wald test, we find that the coefficient estimate for *Founder CEO* is significantly greater than that for *Founder-firm-exec*, suggesting that founder CEOs are more overconfident than executives working at founder firms, a finding that is confirmed by Model 2, with which we conduct a subsample analysis using founder

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

Dependent variable: options	All firms (1)	Founder firms (2)
Founder CEO	0.674***	
	(0.150)	
Founder-firm-executives	0.099	−0.948***
	(0.072)	(0.354)
Professional-firm-executives	−0.173***	
	(0.052)	
Log(executives age)	−0.298**	−0.488
	(0.126)	(0.368)
Male	0.202**	−1.043***
	(0.083)	(0.271)
Log(wealth)	0.250***	0.106
	(0.018)	(0.107)
Log(size)	−0.121***	−0.000
	(0.017)	(0.098)
Monthly volatility	0.135	0.511
	(0.173)	(1.244)
Institutional holding	−0.453***	−0.715***
	(0.072)	(0.203)
Log(price)	0.455***	0.399***
	(0.032)	(0.104)
Earnings surprise	−0.006	4.501
	(0.004)	(3.072)
Past stock market performance	0.400***	0.988***
	(0.107)	(0.085)
Log(market-to-book)	0.514***	0.330***
	(0.027)	(0.067)
ROA	1.712***	0.813**
	(0.188)	(0.416)
Time fixed effects	Yes	Yes
# Observations	20,043	2,524
# Executives	8,026	981
R^2	0.192	0.184

Observations are at the firm-year level, and we include *year fixed effects*.
Robust standard errors are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% or lower levels, respectively.

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firms only. At the same time, a Wald test comparing the estimate for *Founder-firm-exec* with that on *Professional-firm-exec* reveals that executives working at founder firms are more overconfident than executives working at nonfounder firms. This result is in line with the intuition outlined above that some executives have been part of the success story working alongside founder CEOs 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 ≈ professional CEOs ≫ executives working at firms managed by professional CEOs, whereby "≫" denotes differences that are statistically significant at the one-percent level.[13]

We are mindful of the possibility that our options-based results suffer from omitted variable bias in the sense 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 that is not yet reflected in stock prices, 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).[14] The estimate for *Options* is -0.013 (p-value < 0.10). That is, high overconfidence weakly predicts *more negative* stock returns, which contrasts with the positive inside information view.

[13]Some of the executives in our sample may have founded or cofounded their own firms at some point in their careers. Comparing the overconfidence level of founder executives with that of founder CEOs should prove to be an interesting avenue for future research.

[14]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 the persistence of their options-based measure, our measure, which is similar to theirs, is likely to be persistent as well.

Entrepreneurial optimism discount

The results of 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 stock market reaction 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 underlying firms (in terms of a firm's ability to connect with customers and investors), and estimate the following regression equation:

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

$ARet_{i,t+2}$ 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 raw returns minus returns on a value-weighted portfolio of firms that are similar in size and have similar book-to-market ratios and past returns (Daniel *et al.*, 1997). By testing whether the tone of tweets *predicts* future stock market performance, rather than contemporaneously correlating with stock prices, we follow the approach used in the literature (Tetlock *et al.*, 2008: 1452).

To keep information transmitted through tweets 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). *Negative DJNS* and *Negative SA* are the average fractions of negative words across all articles published in the DJNS and SA about a given company. *Negative SA-Comment* is the average fraction of negative words across SA comments posted over days t through $t+1$ in response to the SA articles. $I(DJNS)$, $I(SA)$, and $I(SA\text{-}Comment)$ 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 and/or downgrades for

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

	(1)	(2)	(3)
***Negative** tweets*	−0.015**	−0.014**	−0.011
	(0.007)	(0.007)	(0.008)
Founder CEO		0.001	0.001
		(0.000)	(0.000)
***Negative** tweets × founder CEO*			−0.016
			(0.011)
***Negative** SA*	−0.021	−0.026	−0.027
	(0.143)	(0.139)	(0.139)
I(*SA*)	0.000	0.000	0.000
	(0.003)	(0.003)	(0.003)
***Negative** SA-comment*	0.005	0.005	0.005
	(0.097)	(0.097)	(0.097)
$I(SA\text{-}comment_i)$	−0.001	−0.001	−0.001
	(0.003)	(0.003)	(0.003)
***Negative** DJNS*	−0.093	−0.093	−0.091
	(0.088)	(0.088)	(0.088)
I(*DJNS*)	0.002*	0.002*	0.002*
	(0.001)	(0.001)	(0.001)
Upgrade	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)
Downgrade	−0.005*	−0.005*	−0.005*
	(0.003)	(0.003)	(0.003)
I(earnings announcement)	−0.002	−0.002	−0.002
	(0.002)	(0.002)	(0.002)
Earnings surprise	−0.237	−0.242	−0.241
	(0.529)	(0.531)	(0.530)
Monthly volatility	0.049	0.050	0.050
	(0.036)	(0.036)	(0.036)
$Abnormal\ return_{(t)}$	−0.001	−0.001	−0.001
	(0.014)	(0.014)	(0.014)
$Abnormal\ return_{(t-1)}$	−0.005	−0.006	−0.006
	(0.015)	(0.015)	(0.015)
$Abnormal\ return_{(t-2)}$	−0.027	−0.026	−0.027
	(0.020)	(0.020)	(0.020)
$Abnormal\ return_{(t-60,t-3)}$	−0.004	−0.004	−0.004
	(0.003)	(0.003)	(0.003)
# Observations	7,045	7,045	7,045
R^2	0.028	0.028	0.028

Observations are at the firm-day level, and we include *year-month fixed effects*.
Standard errors are clustered by firm and year-month, and are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% or lower levels, respectively.

the focal company from the IBES recommendation file. Other control variables are as before.

Table 4 reports our findings. The coefficient estimate for *Negative tweets* is -0.015 (p-value < 0.05), suggesting that future abnormal returns are approximately 0.05 percent 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 *Negative tweets × Founder CEO* as additional independent variables, the coefficient estimate for *Founder CEO* is 0.001 (p-value > 0.10) and the coefficient estimate for 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.

DISCUSSION AND CONCLUSION

In this study, we theorize that founder CEOs are more overconfident than their professional counterparts. We find support for our arguments using the

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following four proxies for overconfidence: (1) tone of CEO tweets, (2) tone of CEO statements made during earnings conference calls, (3) management earnings forecasts, and (4) the extent to which a CEO exercises his or her exercisable in-the-money options.

Specifically, we find that founder CEOs use substantially fewer negative words than professional CEOs. This pattern is observed for CEOs' (1) personal tweets, and (2) statements made during earnings conference calls. We also find that (3) founder CEOs tend to provide more optimistic earnings forecasts. Finally, in our analysis of CEO option-exercise behavior, we find that (4) 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 firms. 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 founder CEOs) successfully turn their startups into large publicly traded companies or because CEOs attract like-minded kinds.

Finally, we provide evidence that, to date, investors are unaware of overconfidence bias among founders, and that instead they 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. Founder-managed firms comprise an economically substantial component of the economy and a large body of research has begun to compare the behavior and performance of those managed by founder CEOs with those of firms managed by professional CEOs (e.g., Certo *et al.*, 2001; Fahlenbrach, 2009; Jayaraman *et al.*, 2000; Nelson, 2003; Villalonga and Amit, 2006). While this literature documents several statistically robust differences, we know relatively little about the source that generates the aforementioned differences. We identify one key characteristic along which captains of the largest, and economically speaking, most significant organizations differ, and by doing so, provide an economic explanation for the observed differences in behavior and performance.

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 varying firm outcomes. Our results suggest that differences in overconfidence can be traced, at least partially, to differences in CEO type, that is, whether a CEO is a founder or a professional.

Third, we contribute to the emerging literature on an entrepreneurial optimism discount (e.g., Certo *et al.*, 2001; Dushnitsky, 2010). Several studies argue 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 firms' market value correspondingly. We test this conjecture by studying the market's reaction to founder CEOs' tweets and professional CEOs' tweets. We observe no meaningful difference in market reaction to founder CEOs' tweets and professional CEOs' tweets, suggesting that, in the stock market, investors do not recognize the stronger bias in founder-CEO tweets.

On the methodological front, we point out that overconfidence at the CEO level is not a sufficient condition for explaining firm behavior. We propose a set of measures that, when used jointly, capture overconfidence at the personal and group levels, and can help assess the robustness and validity of the interpretation. In a related contribution, we propose a novel setting—CEO tweets—in which to infer CEO characteristics. We argue that CEO tweets exhibit features (unfiltered, personal, and spontaneous) that are unique and make them attractive for use in future studies, whether on overconfidence or some other personal trait.[15]

Our findings have practical implications for firm stakeholders, including investors, employees, suppliers, and customers as well as for boards of directors. Our results point to differences in overconfidence by CEO type and investors may decide to discount or surcharge their opinions and

[15]In an attempt to facilitate research on this matter, in our Online Appendix (posted on bhwang.com), we make available the full list of CEOs with personal Twitter accounts so that interested readers may easily download and process these tweets.

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predictions accordingly. This is not to say that investors should always and/or unconditionally discount the value of founder-managed firms, as founders' overconfidence may also have positive effects (Navis and Ozbek, 2016). We merely note the possibility that, compared with professional managers, founder CEOs make faster (but less comprehensive) and riskier (but potentially more rewarding) decisions, and they create unrealistic (but perhaps motivating) goals for employees and other stakeholders.

For members of boards of directors, our study suggests that when board members decide whether to replace a founder CEO with a professional CEO, 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.

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