

CEO Overconfidence Across the Firm Lifecycle: Effects on Accounting Outcomes and Stock Market Reactions

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ABSTRACT

This study delves into the relationship between CEO overconfidence and a firm's performance across various stages of its life cycle. Previous research has illuminated how an overconfident CEO's personality can influence critical decisions related to investments, financial reporting, and overall corporate policies. The evolution of a firm happens by shifts in both internal factors, such as investment and managerial choices, and external factors like industry and economic developments. Existing literature suggests that the distinct stages of a firm's life cycle significantly impact decision-making processes and profitability. Our findings reveal that firms led by overconfident CEOs exhibit divergent performance outcomes and display abnormal returns that vary depending on the stage of the firm's life cycle. Notably, they tend to excel and achieve positive future performance (abnormal stock market returns) during the growth, mature and shake out (growth and mature) stages but experience worse accounting performance during the decline stage.

Key Words: CEO Overconfidence; Firm life cycle; Accounting Performance; Stock return.

JEL Classifications: M41, E32, M12, G39

Data Availability: Data are available from the public sources cited in the text.

I. INTRODUCTION

We analyze the influence of CEO overconfidence on firm performance across various stages of the business life cycle, specifically investigating how overconfidence affects profitability and stock returns at different stages. Our findings indicate a positive relationship between CEO overconfidence and firm profitability during the growth, maturity, and shake-out stages, but a negative relationship during the decline stage.

This study is grounded in two streams of research. The first relates to CEO overconfidence, a common trait among top executives that influences investment decisions and financial reporting. Goel and Thakor (2008) suggest that overconfident CEOs, despite sometimes making value-destroying investments, are more likely to be promoted under governance models aimed at maximizing firm value. Upper Echelons theory further asserts that organizational behavior reflects top executives' personal traits (Hambrick & Mason, 1984)¹. Overconfident CEOs tend to overestimate their ability to generate earnings, often leading to discrepancies between actual performance and expectations (Hribar & Yang, 2016). Overconfidence has also been linked to earnings management and financial misreporting (Hsieh et al., 2014; Schrand & Zechman, 2012). These CEOs typically engage in higher levels of investment and M&A activities (Brown & Sarma, 2007; Malmendier & Tate, 2005, 2008), pursue more innovative projects (Galasso & Simcoe, 2011; Hirshleifer et al., 2012), and require more cash inflows to fund these initiatives, resulting in lower cash holdings (Dao et al., 2023). While overconfident CEOs may promote

¹ The central premise of upper echelons theory is that top executives view their situations - opportunities, threats, alternatives, and likelihoods of various outcomes - through their own highly personalized lenses. These individualized constructs of strategic situations arise because of executives' experiences, values, personalities, and other human factors. Thus, according to the theory, organizations become reflections of their top executives (The Palgrave Encyclopedia of Strategic Management, 2014)

profitable investments, their overconfidence can also impose social and professional costs that may hinder firm performance (Anderson et al., 2008).

The second stream of research focuses on the firm life cycle, a concept extensively studied in strategic management, organizational science, financial economics, and accounting. Each life cycle stage—resulting from internal and external factors—has unique attributes, creating distinct challenges and opportunities (Park & Chen, 2006). Life cycle stages have been used to explain variations in dividend policies (DeAngelo et al., 2006; Grullon et al., 2002; Fama & French, 2001), takeover activity (Owen & Yawson, 2010), diversification strategies (Arikan & Stulz, 2016), board composition (Lynall et al., 2002), capital structure (Berger & Udell, 1998), and investment decisions (Richardson, 2006). Understanding a firm's life cycle helps identify its current position and future trajectory.

Despite extensive research on CEO overconfidence and firm life cycles independently, no prior study has examined their combined effect on firm accounting performance and stock returns. We address this gap by investigating how CEO overconfidence impacts corporate decision-making and future performance across different life cycle stages. We hypothesize that the effect of CEO overconfidence on firm performance varies by life cycle stage due to differences in financial and economic conditions. Additionally, we explore the combined impact of CEO overconfidence and firm life cycle stages on future stock returns, providing valuable insights for investors and stock traders.

Our analysis uses a sample of publicly listed US companies from 1992 to 2022. CEO overconfidence is measured using CEOs' option-holding decisions, with overconfidence coded as 1 when the ratio of in-the-money options exceeds 0.67 at least twice during the sample period

(Campbell et al., 2011; Hirshleifer et al., 2012). Firm life cycle stages are determined using Dickinson's (2011) cash flow-based measure, which classifies firms into five stages: introduction, growth, maturity, shake-out, and decline. Unlike sequential models, this measure allows firms to transition non-sequentially between stages, reflecting the realities of many startups.

Our results indicate that firms with overconfident CEOs in the growth, maturity, and shake-out stages show higher profitability, while those in the decline stage experience poorer performance. We also find a positive association between future excess returns and CEO overconfidence in growth and mature stages, suggesting that investors do not fully account for the implications of firm life cycle stages when evaluating future returns. Robustness tests confirm the strength of these findings.

This study contributes to the accounting literature by demonstrating that the interaction between CEO overconfidence and firm life cycle stages significantly influences firm performance. Previous studies have primarily focused on how CEOs' personal traits impact corporate policies without considering life cycle stages. To the best of our knowledge, this is the first study to examine the joint effects of CEO overconfidence and firm life cycle stages on financial and stock market performance.

The remainder of this paper is structured as follows: Section II reviews the relevant literature, Section III presents the research hypotheses, Section IV outlines the data and methodology, Section V discusses the results, and Section VI provides the conclusion.

II. LITERATURE REVIEW

We build our paper based on two strands of literature, CEO overconfidence and business life cycle. While both strands have rich literature, there is no extant research that jointly explores them, especially their joint association with the firms' performance. We endeavor to do so in this paper.

CEO Overconfidence

CEO overconfidence is related to the extensive literature on overconfidence studied by different academic disciplines such as psychology, economics, finance, and accounting. Psychology literature suggests that people judge themselves better than average when comparing themselves to others on positive attributes (Kruger 1999; Alicke et al. 1995; Alicke 1985; Svenson 1981; Taylor and Brown 1988; Larwood and Whittaker 1977). In addition, the social psychology literature on self-serving bias shows that people are more prone to accept responsibility when they succeed but they attribute responsibility to external factors when they fail which in turn increases overconfidence (Miller and Ross 1975; Feather and Simon 1971). Moreover, psychology literature assessing self enhancement posits that people tend to overestimate outcomes, especially if they are committed to them or if they believe they have control over the outcome (Weinstein 1980; Kunda 1987; Weinstein and Klein 2002; Langer 1975).

Prior research argues that overconfidence appears to be more prevalent among CEOs who are more susceptible to these cognitive biases mentioned above (Malmendier and Tate 2005, 2008; Goel and Thakor 2008; Larwood and Whittaker 1977; Kidd 1970; Moore 1977). Building upon this stream of psychology literature, the impact of overconfidence on corporate decision making has been explored. Roll (1986) examines the motives behind corporate takeovers when the premium paid by the bidding firm over the market valuation of the target firm reflects a mistake

made by the decision makers in the bidding firm and posits that managerial hubris (extreme/dangerous overconfidence) can explain this phenomenon in corporate takeovers. Camerer and Lovallo (1999) find consistent evidence with the prediction that overconfidence plays a role in excessive business entry using an experimental setting. Theoretical model developed by Heaton (2002) suggests that managerial optimism which is one of the significant characteristics of overconfident CEOs leads to underinvestment if a positive net present value project requires external financing. Optimistic managers believe that market undervalues their firms' risky projects. That is why they may not be able to invest in firm's positive net present value (NPV) projects that require external financing. This leads overconfident CEOs to overinvest in their internally financed projects because internally financed projects rely on positive cash flows from operating, financing, or investing activities of the firm during the fiscal year over which the CEO has more control.

Several finance studies add to this body of literature by finding an association between CEO overconfidence and distortions in corporate investment policies; overinvestment (Malmendier and Tate 2005; Ben-David et al. 2013), value destroying merger activities (Malmendier and Tate 2008), less use of external finance ((Malmendier and Tate 2011), reduction in dividend payout (Deshmukh et al. 2013), more short term debt usage in the capital structure (Graham et al. 2013), and higher risk taking (Goel and Thakor 2008; Niu 2010). On the other hand, a positive aspect of CEO overconfidence is documented by Galasso and Simcoe (2011) and Hirshleifer et al. (2012). They show that CEO overconfidence leads to an increase in innovation activities of the firms.

Accounting studies contribute to this stream of literature by investigating the effect of CEO overconfidence on accounting, financial reporting behavior and management earnings forecasts.

Schrand and Zechman (2012) find a positive association between managerial overconfidence and financial misreporting by analyzing firms subject to Securities and Exchange Commission (SEC) Accounting and Auditing Enforcement Releases. Ahmed and Duellman (2013) study the relationship between CEO overconfidence and conservatism aspect of financial reporting behavior. Their findings suggest that overconfident CEOs delay loss recognition by using less conservative accounting. Hilary and Hsu (2011) document that forecasts issued by overconfident managers are less accurate and the market reaction to these forecasts are less strong. Hribar and Yang (2016) further explore the impact of managerial overconfidence on the propensity to issue voluntary earnings forecasts and content of these forecasts. They show that both the likelihood of issuing voluntary earnings forecast and the amount of forecast optimism increases with CEO overconfidence.

Business Life Cycle

The second strand of literature to which our paper relates is the notion of firm's business life cycle which has been widely studied in the organization science, strategy, economics, finance, and accounting. Studies in the field of organizational science and strategic management (Chandler 1962; Smith, Mitchell, and Summer 1985; Miller and Friesen 1984; Quinn and Cameron 1983) state that there are some uniform patterns in the development of firms. Thus, life cycle theory introduced models of lifecycle stages. Firms in different life cycle stages have different characteristics which lead them to adopt different strategies and structures even though each model relies on different factors to explain the changing characteristics of organization over time (Quinn and Cameron 1983). The number of life cycle stages proposed differs from model to model and ranges from three to ten categories. This literature suggests that life cycle stages are important tools to assess the firm's evolution motivated by internal and external environmental factors. More

importantly, if firms can utilize their life cycle information effectively and efficiently, then they can optimize the use of their valuable resources which may lead to competitive advantage.

Several studies have investigated the role of firm life cycle on corporate decisions, behavior and performance while employing differing proxies for the firm's life cycle such as firm size, age, years listed on stock exchange, retained earnings, cash flow patterns. Berger and Udell (1998) have posited that life cycle can explain variations on firms' capital structure decisions. Their (1998) study views small business finance through a financial growth cycle paradigm and examines whether capital structures vary across firm size and age used as a proxy for the firm's life cycle stage, finding that optimal capital structures change by life cycle stage. Several studies (Bulan et al. 2007; Coulton and Ruddock 2011; DeAngelo et. al. 2006; Grullon et. al. 2002; Fama and French 2001) provide evidence consistent with the hypothesis that higher retained earnings as a proportion of total equity and total assets increases the probability that publicly traded industrial firms will pay dividends.

Evidence in the managerial accounting literature (Rappaport 1981; Richardson and Gordon, 1980) suggests that firms in different life cycle stages employ different performance measures. Moore and Yuen (2001) show that management accounting system formality varies across the firm life cycle. Anthony and Ramesh (1992) study the relationship between stock return and firm life cycle and document that market reaction to unexpected sales growth and capital expenditure is higher for firms at early life cycle stages. Black (1998) extends the study of Anthony and Ramesh (1992) by investigating whether value-relevance of accounting measures differs across life cycle stages. His results suggest that value relevance of earnings and cash flows is affected by firm life cycle. Lynall et al. (2003) find that the applicability of corporate governance theories to board composition and formation varies across the life cycle stages.

Further, Owen and Yawson (2010) examine whether firm life cycle proxied by earned/contributed capital mix plays a role in firms' takeover decisions. They show that likelihood of firms making a takeover bid is lower in early life cycle stages. Hribar and Yehuda (2015) find that the mispricing of total accruals and free cash flows shows different patterns at different life cycle stages. In a more recent study, Arikan and Stulz (2016) study the changes in the acquisition rate of firms over the life cycle and document that young (1-3 years since IPO) and mature (10-20 years since IPO) firms exhibit higher acquisition rates compared to middle aged firms (4-9 years since IPO). Bulan and Yan (2010) suggest that pecking order theory explains financing decisions of firms differently in different life cycle stages. Dittmar and Dutchin (2011) show that the way firms manage their cash reserves is a function of firm life cycle.

From the above literature review, it is evident that effect of firm's life cycle on its strategy, structure and decision making is important to understand. Therefore, we extend this literature to examine the role of CEO overconfidence in different life cycles stages and its implication for firm performance. While there is no universal agreement as to mapping of firms into different life cycle stages, Dickinson (TAR, 2011) is considered state of the art and relies on cash flow patterns from operating, investing, and financing activities as the proxy for defining the various life cycle stages for the firm which is generally considered a superior measure and widely used in accounting and finance literature. We adopt this measure in our study to understand the interaction of firm's life cycle stages with CEO overconfidence and joint impact on firms' performance.

Introduction

Miller and Friesen (1984) describe the firms at this stage as being young, small, and dominated by owner-managers with an informal structure and considerable innovation. Operating cash flows are expected to be negative since firms in this stage have neither established customers

nor sufficient information about potential revenues and costs (Jovanovic 1982). Investing cash flows are expected to be negative since firms have a heavy demand for large investments to deter market entry by potential competitors (Jovanovic 1982). Since firms at this stage have limited internal funds, they need to obtain funds from external sources to support its operations and investments which result in positive financing cash flows.

Growth

Firms in this stage are characterized as medium sized with some formalization of structure and rapid growth (Miller and Friesen 1984). Because of optimal investment choices and increased technical efficiency, profit margins are maximized in this stage, leading to positive operating cash flow (Spence 1977, 1979, 1981). Investing cash flows are still expected to be negative due to the same reasons mentioned in introduction stage. Firms still have negative financing cash flows in this stage since positive operating cash flows are not enough to cover high investment activities. Thus, firms still need to rely on external financing.

Mature

Miller and Friesen (1984) define this period in which firms are larger with stabilized sales and declining innovation levels and have formal structure. Since profit margins are maximized in this stage, operating cash flows are expected to remain positive. Investing cash flows are expected to be still negative as firms in this stage keep making investments to maintain existing assets (investments are made for replacement purposes not for expansion purposes) even though they exhibit relatively lower levels of investments compared to firm in the preceding stages. It is expected that financing cash flows will turn out to be negative for firms in this lifecycle stage because of having positive operating cash flows and fewer investment opportunities.

Shake-Out

The combinations of the type of other cash flows that do not fit into other categories are classified as shake-out phase by Dickinson (2011) since economic theory does not provide enough information to make directional predictions on the sign of three types of cash flows. (There are three type of cash flows which can be positive or negative, hence, there are 2^3 or eight possible combinations).

Decline

The literature on life cycle theory defines this stage by market stagnation, low level of innovation, slow growth, and liquidation of subsidiaries (Miller and Friesen 1984). The reductions in the operating results of the firm continue in this stage, thus operating cash flows are expected to be negative. Firms in this stage exhibit negative investing cash flows since they sell assets to obtain funding for operations and pay existing creditor. Dickinson (2011) states that it is not possible to make a directional prediction on the sign of financing cash flows due to the lack of information in the literature.

In the subsequent section, we delineate both overarching hypotheses and individualized ones customized for each life cycle stage. These are developed to explore the correlation between CEO overconfidence, life cycle stages, and firm performance, both operating and market.

III. HYPOTHESES DEVELOPMENT

CEO Overconfidence, Life Cycles and Operating Performance

Overconfidence is a tendency that makes people overestimate their knowledge and capabilities, and then they expect a more desirable or even unrealistic outcome (Bhandari and Deaves 2006; Gilson 1989; Taylor and Brown 1988; Weinstein 1980). Overconfidence in the CEO population is more prevalent; relative to the general population overconfident managers are

more likely to be promoted to become CEO when competing with other kinds of managers (Goel and Thakor 2008). Moreover, overconfident CEOs tend to over-estimate their ability and the probability of achieving good performance. They are highly committed because of their self-interests such as bonus and professional reputation concerns (Gilson 1989). Overconfidence is prevalent during the early career of the CEOs or after having certain positive experience.

The optimistic bias of overconfident CEOs could affect their decision-making processes about important investment decision and corporate reporting policy. Schrand and Zechman (2012) find that overconfident CEOs are more likely to conduct intentional misstatements when their actual performance could not meet their expectation. Overconfident CEOs also tend to issue more debt and overvalue corporate investment projects and thus invest in risky projects (Hackbarth 2003; Heaton 2002; Malmendier et al. 2011). They tend to have higher investment level, and/or mergers & acquisitions (Brown and Sarma 2007; Malmendier and Tate 2005; 2008). On the other hand, firms with high level investments also need to allocate more financial resources to support their investment activities (Richardson 2006). Thus, firms with overconfident CEOs would need more financial resources available to satisfy their various cash outflow needs.

Following above arguments, overconfident CEOs need to generate higher level of income to meet their earnings expectations; meanwhile, they also need to allocate more economic resources for additional investments and business expansions. Firms' life cycles may affect the profitability and rate of return of the companies (Dickinson, 2011). Firms in different life cycle stages generate different types of cash flows that may force CEOs to look for alternative resources for their investment portfolios. For example, during maturity stage firms have positive cash flow from operations that provides cash for CEOs to use in their investment plans. Therefore, profitable firms generate resources for CEOs to use that may affect their corporate decision making. If firms

are profitable then they may continue with their investment strategies otherwise they may flush out their non-profitable investments quicker than the other firms with non-overconfident CEOs. Hsu et al. (2017) suggest that accounting conservatism attenuates overconfidence bias, thereby resulting in better future performance in an entity run by an overconfident CEO.

On the one hand there is a negative side to CEO overconfidence since some studies find that there is a negative relation between CEO overconfidence and firm value (Chen et al. 2015; Kim et al. 2016). On the other hand, some studies suggest that it can induce decisions which benefit firm value under some conditions (Hirshleifer et al. 2012). Prior literature on life cycle theory shows that the effect of business activities guided by strategic decisions on the operating and financial results varies in different life cycle stages. (Anthony and Ramesh 1992; Black 1998; Park and Chen 2006). Different economic attributes described by life cycle stages together with business activities have an important role in the operating performance of the firm. Park and Chen (2006) suggest that the way firms manage the business should change as a function of life cycle stage. In addition, studies in the organizational literature posits that understanding the life cycle principles can induce firms to manage their resources in an optimal manner which will in turn bring success. Several studies in strategic management, accounting and finance demonstrate the impact of life cycle on corporate decisions such as: (a) takeover activity and diversification (Arikan and Stulz 2016); (b) M&A activity (Owen and Yawson 2010); (c) board composition (Lynall et al. 2003); (d) management accounting systems (Moores and Yuen 2001); (e) capital structure (Bender and Wand 1993; Berger and Udell 1998); (f) investment choices (Richardson 2006); (g) dividend policies; (h) profitability and valuation (Dickinson 2011); and (i) accounting conservatism (Park and Chen 2006).

Since both overconfidence and firm life cycle directly influences decision-making, it is logical to investigate whether they have a joint effect on firm performance. We predict that the effect of managerial overconfidence on future firm performance will differ at different stages in the firm's life cycle due to the differences in their economic attributes. By following above arguments, we hypothesize that:

Hypothesis 1: CEO overconfidence will affect the firms operating performance differently in different firm life cycle stages.

In the introductory stage of the business life cycle, we suggest that CEO overconfidence will not have a measurable impact on the operating performance (profitability). Firms in the introductory stage are typically young, small, and dominated by owner-managers with an informal structure and high levels of innovation (Miller & Friesen, 1984). During this phase, operating cash flows are often negative due to the firm's focus on market entry, investment in innovation, and lack of established customers or reliable revenue streams (Jovanovic, 1982). These characteristics suggest that at the introductory stage profitability may be driven more by external market conditions and the firm's strategic investments than by CEO decision-making behaviors.

Overconfident CEOs might overestimate their ability to control outcomes or succeed in early-stage ventures (Kruger, 1999; Alicke et al., 1995). However, in the introductory stage, the firm's operating performance is a result of necessary investments to enter the market and secure a competitive position. The literature indicates that at this stage, firms often need to rely on external financing to support operations, making short-term profitability largely independent of CEO behaviors (Dickinson, 2011). Thus, we suggest that:

Hypothesis 1a: There will be no relationship between CEO overconfidence and a firm's operational profitability at the introductory stage of the lifecycle.

In the *growth stage* of a firm's business lifecycle, companies are typically undergoing rapid growth, with some formal structure. They tend to have optimized investment choices and increased technical efficiency, leading to maximized profit margins and positive operating cash flows. However, investing cash flows remain negative due to continued high investment activities, and firms still rely on external financing as their operating cash flows are not sufficient to cover these investments. The business market is expanding rapidly, offering numerous new investment opportunities.

In this stage, overconfident CEOs could result in the pursuit of ambitious projects. Although this might lead to overextension, overinvestment, the natural growth trend of the business lifecycle may be reinforced with the activities of the overconfident CEOs. While the confidence might drive rapid expansion, the profitability may be lifted by the rising tides of the business life-cycle.

Hypothesis 1b: At the growth stage of the business life cycle, CEO overconfidence will positively impact the operating performance (profitability) of the firm.

While the mature stage of a firm's lifecycle typically suggests a period of stability and consolidation, in this stage overconfident CEOs can serve as a catalyst for strategic initiatives that rejuvenate the firm's operations and market approach. This can lead to sustained or even enhanced profitability, contrary to the conservative management approaches that typically dominate this lifecycle stage. Overconfident CEOs, in this stage, may push for more aggressive operational efficiencies. They might invest in new technologies or processes that enhance productivity, thereby reducing costs and improving profit margins beyond the industry standard. Overall, our next hypothesis posits that overconfident CEOs, by virtue of their risk-taking

propensity and strong belief in their strategic vision, can positively influence the operating performance of firms in the mature stage of their lifecycle.

Hypothesis 1c: At the mature stage of the business life cycle, CEO overconfidence will positively impact the operating performance (profitability) of the firm.

The *shakeout stage* of a firm's lifecycle is characterized by a reduction in the number of competitors within the market. This stage can result from various factors, such as increased competition, market saturation, or technological changes, leading to the exit of less competitive firms. Dickinson (2011) categorizes this stage as having cash flow patterns that do not fit neatly into the categories associated with other lifecycle stages, making it difficult to predict the direction of operating, investing, and financing cash flows based on economic theory alone. Therefore, in the shake-out stage companies have various reactions. In this stage in the face of shrinking market and declining profits some companies may adopt revival strategies to prolong their survival time, some may invest more in innovation and R&D to stay afloat or to open new growth avenues. Overall, shakeout stage can prove to be quite unpredictable.

CEO overconfidence can instill a sense of resilience and optimism within the organization during uncertain times. This can be vital for maintaining morale and motivation across the workforce, driving productivity even as market conditions deteriorate. In this stage CEO overconfidence can paradoxically become an asset, driving the firm towards innovative practices, strategic realignment, and aggressive market consolidation efforts. These actions, fostered by the CEO's assertive belief in their strategies and their firm's capabilities, can significantly enhance the operating performance and profitability of the firm during a critical phase of its lifecycle. Accordingly, we hypothesize that:

Hypothesis 1d: At the shakeout stage of the business life cycle, CEO overconfidence will positively impact the operating performance (profitability) of the firm.

The decline stage of a firm's life cycle is characterized by market stagnation, low innovation, slow to negative growth, and potentially the liquidation of subsidiaries. In this stage firms face significant challenges. These include continued reductions in operating results and negative operating and negative cash flows. Despite these challenges, CEO overconfidence could, under certain conditions, have a positive impact on both operating (profit) performance and market (stock return) performance.

In the face of a proven decline, a CEO's overconfidence in their ability to turn the company around could result in innovative or unconventional strategies that could stabilize or improve the firm's profitability. CEO overconfidence can lead to a negative impact on operating performance by driving bold and decisive actions that might not otherwise be considered by a more risk-averse leader. In a decline stage an overconfident CEO might continue overinvesting, does not divest non-core assets more efficiently (aggressive restructuring), or may not pivot the firm's strategy towards more promising markets or products. Overall, in an environment where many exit the market, their overconfidence could lead to an escalation of commitment , and this commitment of overinvestment may hurt firm performance. Accordingly, we suggest that:

Hypothesis 1e: At the decline stage of the business life cycle, CEO overconfidence will negatively impact the operating performance (profitability) of the firm.

CEO Overconfidence, Life Cycles and Market Performance

Next, we examine the joint effect of CEO overconfidence and firm life cycle on the prediction of future stock return. For instance, because overconfident CEOs typically underestimate future uncertainty, they are more likely to continually miss their own management forecasts and thus are more likely to cause a stock price crash for not being able to course correct

(Chen et al. 2015; Kim et al. 2016). While it is also possible that CEO overconfidence may lead to better opportunity set for investment and greater overall investment in some lifecycle stages which may lead to increase in firm value. This is more likely to happen in lifecycle stages where cash is plenty available for CEO to invest in value enhancing projects. This value enhancement or possible value destruction due to CEO overconfidence will be impounded in stock return performance of the firm. Following the above argument, we hypothesize that.

Hypothesis 2: The stock return will vary systematically between overconfident CEO and other CEOs in different life cycle stages of the firm.

In the introductory stage, we suggest that CEO overconfidence will not significantly affect market (stock) performance, as investors are primarily focused on potential growth and innovation prospects.

As we mentioned in Hypothesis 1a, firms in the introductory stage of their lifecycle are usually young, small, and primarily focused on innovation and market entry (Miller & Friesen, 1984). At this stage, the firm has limited historical financial data and a lack of established revenue streams, leading to significant uncertainty about its future success (Jovanovic, 1982). Investors typically price stocks of these firms based on speculative expectations of future growth and potential, rather than short-term performance or the CEO's overconfidence. While even at the introductory stage overconfident CEOs may push for aggressive growth strategies or overinvestment, these actions are unlikely to influence immediate stock market performance in the early phase, when investor decisions are driven primarily by market trends, product viability, and external factors. Given the inherent uncertainty of this stage and the speculative nature of stock performance, the CEO's cognitive biases are unlikely to play a significant role in shaping market reactions. In other words, we suggest that

Hypothesis 2a: There is no significant relationship between CEO overconfidence and a firm's market (stock) performance at the introductory stage of the lifecycle.

During the growth stage of a firm's lifecycle, CEO overconfidence can contribute positively to stock market performance by driving aggressive growth strategies, effectively communicating with external stakeholders, and making bold investment and financing decisions. These actions, underscored by a confident leadership style, can enhance investor confidence, and elevate stock performance, aligning perceived firm value with its growth trajectory. Overconfident CEOs' persuasive abilities and strong presence can also aid in securing external financing under favorable terms, which supports sustained growth without diluting existing shareholders' value excessively. The market often responds positively to strong leadership and clear growth strategies, especially in the growth stage of a firm.

Hypothesis 2b: At the growth stage of the business life cycle, total impact of CEO overconfidence will positively impact the market (stock) performance of the firm.

In the mature stage of a firm's lifecycle, characterized by stabilized sales, maximized profit margins, and formalized structures, CEO overconfidence can play a nuanced role in impacting stock market performance. Despite a typical reduction in aggressive growth strategies and innovation in this stage, an overconfident CEO might leverage their firm's established market position and operational strengths to enhance stock market performance. In this stage CEO overconfidence can contribute positively to stock market performance by leveraging stable operations for strategic asset optimization, communicating effectively with investors, and implementing financial maneuvers that enhance shareholder value. This hypothesis posits that overconfident CEO's bold and assertive management style can invigorate the market's perception

of the firm, leading to positive stock market outcomes even in a stage characterized by general market stability and slower growth.

Hypothesis 2c: At the mature stage of the business life cycle, total impact of CEO overconfidence will positively impact the market (stock) performance of the firm.

In the shakeout stage is marked by competitive pressures, consolidation, and inconsistent financial outcomes (Miller & Friesen, 1984). Firms may experience uncertainty regarding prospects, with various outcomes depending on how they adapt to market competition and external conditions. During this stage, stock performance is often volatile and difficult to predict, as firm outcomes are contingent on strategic shifts. As outlined by Dickinson (2011), there are no clear directional predictions on the cash flows for firms in the shakeout phase. Similarly, the market's perception of firms in this stage is influenced by broader industry consolidation trends, external competitive forces, and market saturation. These external factors are likely to overshadow any influence CEO overconfidence might have on stock performance. Therefore, we hypothesize that:

Hypothesis 2d: There is no significant relationship between CEO overconfidence and market performance during the shakeout stage of the firm's life cycle.

Firms in the decline stage face market stagnation, declining innovation, and reduced growth opportunities (Miller & Friesen, 1984). At this point, firms are typically liquidating assets or downsizing operations to survive in a contracting market. Stock performance is usually impacted by negative investor sentiment and reduced market interest. At this decline stage, CEO overconfidence might lead to decisions aimed at reversing the firm's fortunes, such as risky acquisitions or attempts to reinvest in failing divisions. However, these actions are unlikely to

significantly affect stock performance, as investors tend to be pessimistic about firms in this phase. Any bold actions taken by an overconfident CEO may be viewed with skepticism, and investors are more likely to focus on the firm's declining fundamentals rather than the leadership behavior. Thus, we hypothesize that:

Hypothesis 2e: There is no significant relationship between CEO overconfidence and market performance during the decline stage of the firm's life cycle.

Overall, we suggest that operating and market performance of firms led by overconfident CEOs will differ from those led by other CEOs across various stages of a firm's lifecycle (introduction, growth, maturity, shakeout, and decline). We suggest that this variation can be attributed to not only the macroeconomic conditions, but also the distinct ways in which overconfident CEOs approach decision-making, investment decisions, and risk management compared to their less overconfident counterparts. The key underlying factor is the overconfident CEO's willingness to take on greater risks based on their belief in their own ability to succeed where others might fail. This confidence can lead to decisions that diverge significantly from those a more risk-averse CEO might make, resulting in different patterns of stock return performance across the firm's lifecycle stages. These hypotheses are summarized below:

-----*Please include appendix #2 around here* -----

IV. EMPIRICAL DESIGN

Measure of CEO Overconfidence

Following previous studies (Hall and Murphy 2002; Malmendier and Tate 2005; and Campbell et al. 2011), we adopt an option-based overconfidence measure, CO , to identify overconfident CEOs (CO takes the value of 1 if a CEO fails to exercise executive options with

moneyness higher than 67% at least twice during the sample period and is set to zero otherwise). Hall and Murphy (2002) first introduce the certainty-equivalence framework to analyze top executives' behavior regarding their option packages. The basic assumption of this framework argues that options granted for risk-averse executives who do not have diversified investment portfolio would be exercised immediately at the day of vesting to realize the benefits. Based on this framework, Malmendier and Tate (2005) argue that CEOs' investment portfolios are highly influenced by the idiosyncratic risks of their firms due to the restrictions on hedging or diversifying their investments. Unlike external investors, CEOs cannot hedge their investment risk by short-selling company stocks, and their human capital is highly related to the firm's economic performance. Therefore, rational CEOs would be less likely to become a net holder of their company's stocks' options (holding more than two thirds, 67%, on their portfolio) due to their under-diversified investment portfolio. However overconfident CEOs would be more likely to become net holder of their companies' stocks options due to their optimistic expectations of their companies' future performance.

Following Campbell et al. (2011), Hirshleifer et al. (2012), Ahmed and Duellman (2013), Hsu et al. (2017), Chen et al. (2020) and Lai et al . (2021), we develop the overconfidence measure from ExecuComp data and follow the three steps to estimate average CEO option moneyness. In first step, we divide the total realizable value of the exercisable options by the total number of exercisable options to calculate the realizable value per option. Then we deduct this calculated value from the stock price at the fiscal year-end to estimate the average exercise price of the exercisable options. In the final step, we estimate the average percent of moneyness of a CEO's exercisable options as the average realizable value per option divided by the average exercise price . A CEO is identified as an overconfident CEO if she/he holds his/her company's stocks

options that are more than 67% “in the money” at least twice during our sample period ($CO=1$, identifies an overconfident CEO; $CO=0$, otherwise) . A CEO is classified as overconfident from the first time they exhibit this stock option holding behavior and retain this classification for the remainder of the sample period.

Measures of Lifecycles

We follow Dickinson (2011) to construct lifecycle proxy which is a combination of a firm’s operating, investing, and financing cash flows. Since each cash flow type can be either positive (inflow) or negative (outflow), there are eight possible cash flow combinations. She groups these combinations into 5 life cycle stages defined as Introduction, Growth, Mature, Shake-Out and Decline.²

The following table retrieved from: Dickinson (2011, p. 1974) provides an overview of how we assign firm-year observations to the 5 business life cycle stages. One of the main advantages of this proxy is that firms are allowed to move through lifecycle stages in a non-sequential way. In other words, lifecycle stages each firm pass through do not have to be in sequential order as is true in age-based classification.

Dickinson (2011) developed this measure of lifecycle stages adopting Gort and Klepper (1982)’s five life cycle stages definition. Similarly, Miller and Friesen (1984) grouped corporate life cycle into five phases. Both studies rely on the theoretical/conceptual literature on how corporations evolve over time in management literature. Each stage represents the variation in a

² Please refer to Dickinson (2011) for more information on the argument and analysis about the classification of firms into different life cycle stages based on cash flow statement data.

firm's characteristics, performance, growth, and risk which can also be captured by three types of cash flows: operating, investing, and financing. The linkage of operating, investing, and financing cash flows with life cycle theory is summarized below.

-----*Please include Appendix #3 around here* -----

Miller and Friesen (1984) characterize firms in the introduction stage as youthful, small-scale enterprises predominantly led by owner-managers, operating with an informal organizational structure, and marked by significant innovation. As firms progress into the growth stage, they tend to attain a medium size, undergo some level of structural formalization, and experience rapid expansion (Miller and Friesen, 1984). Furthermore, Miller and Friesen (1984) delineate the mature stage wherein firms achieve larger scales, stabilize sales, witness declining levels of innovation, and adopt formalized structures.

Dickinson (2011) identifies the amalgamation of non-classifiable cash flow types as constituting the shake-out phase, a term attributed due to the inadequacy of economic theory to provide conclusive directional predictions on the signs of these cash flows. According to the life cycle theory literature, the decline stage is demarcated by market stagnation, minimal innovation, sluggish growth rates, and the liquidation of subsidiaries (Miller and Friesen, 1984). This phase is characterized by ongoing reductions in the firm's operating results, resulting in anticipated negative operating cash flows.

Regression Models

CEO Overconfidence, Life Cycle and Profitability

To test the interaction effect of CEO overconfidence and lifecycle on companies' future profitability, we estimate the following modified regression model from Dickinson (2011).

$$\begin{aligned}
\Delta RNOA_{i,t+1} = & \alpha_1 RNOA_{i,t} + \alpha_2 \Delta RNOA_{i,t} + \alpha_3 GR_NOA_{i,t} \\
& + \alpha_4 \Delta ATO_{i,t} + \alpha_5 \Delta PM_{i,t} + \sum_{k=1}^5 \beta_k LC_{i,t} \\
& + \sum_{k=1}^5 \gamma_k LC_{i,t} \times CO_{i,t}
\end{aligned} \tag{1}$$

The dependent variable labeled $\Delta RNOA_{i,t+1}$ is one year ahead change in return on net operating assets (RNOA). Following Fairfield and Yohn (2001), we include several variables that are useful in explaining future profitability. We control for current return on net operating assets (RNOA), current change in return on net operating assets ($\Delta RNOA$), change in asset turnover (ΔATO), change in profit margin (ΔPM) and growth in net operating assets (GR_NOA). Prior research documents that profitability is mean reverting (Freeman et al. 1982; Brooks and Buckmaster 1980), thus we expect RNOA to be negatively associated with change in RNOA in the next period. Since prior research reports a negative association between capital expenditures and next period's earnings changes, we expect that GR_NOA is associated with lower profitability in the next period. In addition, the coefficients on ΔATO and ΔPM are expected to be positive and negative respectively (Dickinson 2011). LC and CO are indicator variables for lifecycle stages and CEO overconfidence respectively as defined earlier. We also include interaction terms of CEO overconfidence and five life cycle indicator variables ($CO \times LC$) to test whether CEO overconfidence affects the association between lifecycle measures and future profitability. A negative (positive) coefficient on α_1 is consistent with a decrease (increase) in future performance. A no intercept model is used so that we can interpret whether the coefficients on each life cycle stages are significantly different from zero. We also suppress the coefficients on the variable indicating CEO overconfidence because this variable is a linear combination of the variables indicating lifecycle stages. We also include year and industry fixed effects to control for macroeconomic conditions and industry specific factors.

CEO Overconfidence, Life Cycle and Market Performance

To test our second hypothesis, we replace the dependent variable in Equation 1 with one year ahead buy and hold annual excess return ($BHAR_{i,t+1}$).

$$\begin{aligned} BHAR_{i,t+1} = & \alpha_1 RNOA_{i,t} + \alpha_2 \Delta RNOA_{i,t} + \alpha_3 GR_NOA_{i,t} + \alpha_4 \Delta ATO_{i,t} \\ & + \alpha_5 \Delta PM_{i,t} + \sum_{k=1}^5 \beta_k LC_{i,t} + \sum_{k=1}^5 \gamma_k \gamma_k LC_{i,t} \times CO_{i,t} \end{aligned} \quad (2)$$

We kept all the independent variables the same. As profitability regression, we suppress the coefficients on the variable indicating CEO overconfidence because this variable is a linear combination of the variables indicating lifecycle stages. We compute buy and hold abnormal returns as the difference between buy and hold annual return and buy and hold annual return of value weighted market return and accumulated returns from the beginning of the fourth month of year $t+1$ through third month of year $t+2$. In our regression analyses, we adjust the standard errors by firm and all tests of significance are two tailed. Our variable of interest is the coefficient on the interaction term which captures whether the association between future market performance and CEO overconfidence is contingent upon firm life cycle. A positive (negative) coefficient on each of the interaction terms is consistent with an increase (decrease) in future performance in companies that are run by overconfident CEOs within different life cycle stages.

Data

The sample in this study includes all US firms listed on the NYSE, AMEX, and Nasdaq with available data in Compustat during the period 1992-2022. We measure the dependent (independent) variables in year $t+1$ (year t). We exclude firm-year observations with missing data for the research variables used in our regressions. Following Dickinson 2011, we require that average net operating assets, sales revenue, absolute book value of equity or market value of equity of each firm be greater than \$1 million since small denominators lead to skewness in the

profitability ratios. We further exclude all financial firms (SIC codes between 6,000 and 6,999). We then intersect this Compustat data with CEO option holdings data from ExecuComp, used for the construction of CEO overconfidence measure, resulting in 29,279 firm years observations for our main sample. For further analysis, we then merge this data with the Center for Research in Securities Prices (CRSP) to obtain stock return data and the sample sizes slightly diminish when additional data is needed.

V. EMPIRICAL RESULTS

Descriptive Statistics

Table 1 reports the descriptive statistics for the variables used in our regression analysis. Our performance measure (the change in RNOA one year ahead) and RNOA have mean values consistent with Fairfield and Yohn (2001). The mean values of RNOA and GR_NOA are 0.121 and 0.168 respectively. These values are higher than those reported by Dickinson (2011). This difference suggests that firms in our sample are more profitable than that of Dickinson (2011) and using their operating assets more effectively even though their investment levels in operating assets are higher.

The mean value of overconfidence is 0.531 indicating that the proportion of CEO years identified as overconfident are like the statistics reported by prior studies on CEO overconfidence (Humphery-Jenner et al., 2016). We observe the largest and smallest number of observations in the mature and decline stages in our sample. The mean value of Mature is 0.537 while the mean value of decline is 0.022, suggesting that the greatest (lowest) frequency of observations in our sample are assigned to mature (decline) stage. This result is consistent with Dickinson (2011) who attributes this pattern to the stability of the mature stage and the transitoriness of the decline stage.

-----*Please include Table 1 around here*-----

Table 2 presents the Pearson correlations among the variables. Consistent with prior research, current profitability (RNOA), change in profitability (Δ RNOA), growth in net operating assets (GR_NOA) and change in profit margin (Δ PM) are negatively and significantly correlated with one year ahead change in profitability (FORWARD_ Δ RNOA) at less than 1 percent while the association between change in asset turnover (Δ ATO) and one year ahead change in profitability is significantly positive. In addition, we observe a significantly negative relation between CEO overconfidence and one year ahead change in profitability (FORWARD_ Δ RNOA). CEO overconfidence is negatively and significantly correlated with introduction, mature, shakeout and decline stages while there is a positive and significant association between CEO overconfidence and growth stage. In addition, CEO overconfidence is significantly and positively correlated with RNOA, Δ RNOA and GRNOA. All these results show that life cycle stages and CEO overconfidence are significantly linearly correlated with firm's profitability measures.

-----*Please include Table 2 around here*-----

Table 3 presents the frequency observations in each RNOA decile across life cycle stages for firm year observations with overconfident CEOs. The observed patterns are like those reported by Dickinson (2011). The lowest three deciles of RNOA consist of approximately 68% and 79% of introduction and decline firms respectively. On the other hand, just 23% of mature firms are gathered in the lowest three deciles of RNOA. This observation indicates that lowest deciles are overpopulated in introduction and decline stages while they are underpopulated in the mature stage. In addition, we do not observe any notable overpopulation of highest deciles in a specific life cycle stage. Figure 1 plots mean ROA for each life stages. Consistent with expectations, the

magnitude of mean RNOA is highest in mature stage while both growth and shake-out stages have positive mean RNOAs in our sample.

-----*Please include Table 3 and Figure 1 around here*-----

Main Results

Throughout our analyses, all the continuous variables are winsorized at the top and bottom one-percentiles by following the prior literature. In addition, all *t* statistics are based on standard errors clustered by firm and all tests of significance are two tailed and we followed Petersen (2009) for robust regression estimates. Table 4 reports the results of Equation 1 that estimates to test our first hypothesis 1. The coefficients on profitability variables (RNOA, ΔRNOA, GR_NOA, ΔATO), except for the one on ΔPM, are highly significant in expected directions, consistent with Dickinson (2011). The coefficients on RNOA and ΔRNOA are -0.383 and -0.111 respectively at 1% level significance, confirming the mean reverting behavior of profitability documented by prior literature. The significant negative effect of GRNOA on future profitability indicates that investments in NOA exhibit diminishing return (Fairfield and Yohn 2001). ΔATO has the expected sign and is significant. As explained by prior literature, the increase in ATO is a sign of an increase in asset usage efficiency which in turn causes sales to rise.

In Hypothesis 1a, we predicted a negative association between the CEO overconfidence and future firm profitability at the introductory stage. Hypothesis 1b- 1e predicts a positive association on this relationship at the rest of the stages. The results show all stages interactions with CEO overconfidence except introductory and decline stages show a positive coefficient, suggesting that these stages positively impact firm performance, with the coefficient significant in growth, mature, and shakeout stages, supporting our hypotheses 1b, 1c, and 1d. This indicates that overconfidence in these stages contributes positively to changes in operating performance,

potentially due to aggressive growth strategies and efficient management practices enhanced by confident leadership. Overall, our results confirm that life cycle stages play a significant role in driving changes in operational efficiency and profitability. The coefficients on the interaction terms of CEO overconfidence and five life cycle stages capture the incremental effect of overconfidence on future profitability across different life cycle stages. As shown in table 4, the coefficients on Growth \times CO, Mature \times CO, and Shake-Out \times CO are significantly positive at 1%, 1% and 5% level respectively. Thus, we observe an incremental increase in the future profitability for growth, mature and shake-out firms if they are managed by overconfident CEOs. These interaction coefficients indicate that firms with overconfident CEOs in those stages perform better in the next period relative to other firms. We do not observe the similar results for introduction and decline stages when firms need external financing to continue their operation and even survive. These results are consistent with our expectations about the behaviors and choices of overconfident CEOs. The evidence provided in this section is consistent with overconfident CEOs increasing future profitability in growth, mature and shake-out stages. The results for the control variables are like the ones reported by Dickinson 2011.

-----*Please include Table 4 around here*-----

To test our set of second hypotheses, hypotheses 2a-2e, equation 2 is estimated using one year ahead buy and hold annual excess return ($BHAR_{i,t+1}$) as the dependent variable and the results are reported in Table 5. The coefficients on RNOA, GR_NOA and ΔPM are significantly negative. We find statistically significant positive coefficients on Growth \times CO and Mature \times CO, supporting our hypotheses 2b, and 2c. These results indicate that CEO overconfidence in these stages correlates with higher abnormal returns, potentially because the assertive and strategic

decisions expected from overconfident CEOs can impress investors and positively influence perceptions, especially in stages where strategic clarity and bold moves might be highly valued. These marginal effects indicate that firms in the growth and mature stages exhibit higher undervaluation because the valuation implications of CEO overconfidence in these stages are not recognized by investors. Firms with overconfident CEOs in growth and mature stages earn positive excess returns of 3.4% and 2.55% respectively. It appears that investors' underestimation of valuation implications of growth and mature stages only apply to firm with overconfident CEOs and not to those with non-overconfident CEOs. Our findings indicate no significant impact on the introduction, shakeout, and decline stages of firm lifecycle, aligning with the prevailing market anticipations. In these stages, CEO overconfidence tends not to captivate investor attention as these firms are typically bolstered by alternative information channels available to the investors. This pattern underscores a nuanced understanding of how market expectations shape investor reactions across different stages of a firm's lifecycle.

-----*Please include Table 5 around here*-----

To summarize, we present evidence in table 4 & 5 indicating that firms in Growth, Mature and Shake-Out (decline) stages with overconfident CEOs exhibit higher (lower) future profitability and this incremental impact of CEO overconfidence in growth and mature stages do not appear to be anticipated by investors, resulting in temporary mispricing of these firms' stocks. This finding is novel because, there is an opportunity for informed equity investors to earn excess return, and it also shows that firms with overconfident CEOs are undervalued or mispriced by the investors.

Robustness Tests

We test the robustness of our findings by employing three alternative measures of CEO overconfidence: Holder90, Holder100, and Residual_Holder67. First, consistent with Hsieh et al. (2014), Huang et al. (2016), and Laia et al. (2021), a CEO is identified as overconfident (referred to as Holder90) if they hold options that are more than 90% in the money. We then repeat our analysis with an alternative threshold, used by Kim et al. (2016) and Chen et al. (2020), and construct Holder100 if the moneyness of the CEO's non-exercised, exercisable options exceeds 100%. Our final alternative overconfidence measure, based on Banerjee et al. (2015), Banerjee et al. (2018), and Laia et al. (2021), regresses our primary overconfidence measure on the firm's stock return to isolate the component of CEO overconfidence that is not solely attributable to stock performance. A CEO is classified as overconfident if the residual from this regression is greater than zero. Table 6, Panel A, presents the findings from the regression analysis using these alternative measures, which are very similar to the results presented in Tables 4 and 5, thereby supporting our hypotheses.

In our main analysis, which examines the influence of CEO overconfidence on firm performance across various stages of the business life cycle, we use a pooled sample with interaction terms. This model suppresses the dummy variable for CEO overconfidence because it is a linear combination of the dummy variables representing the life cycle stages and their interactions with the CEO overconfidence dummy variable. To address concerns regarding this research design, we re-run our main tests by conducting separate regressions for each life cycle stage. The results, presented in Table 6, Panel B, support our primary findings.

----- Please include Table 6 around here -----

Propensity Score Matching (PSM)

We also do robustness test by propensity score matching for any kind of endogeneity issues and use the below equation to find the matching sample.

$$CO = \alpha + \beta_1 XSINVEST_INDADJ + \beta_2 CAPEX_INDADJ + \beta_3 XRD_INDADJ + \beta_4 ACQUIRE_INDADJ + \beta_5 DIVYLD + \varepsilon \quad (3)$$

where XSINVEST_INDADJ: The amount of excess investment in assets from the residual of a regression of total asset growth on sales growth run by industry-year; CAPEX_INDADJ: Capital expenditures scaled by average total assets, adjusted for the industry median in a given year; XRD_INDADJ: R&D expenditures scaled by average total assets , adjusted for the industry median in a given year; ACQUIRE_INDADJ: Net acquisitions from the statement of cash flows scaled by average total assets , adjusted for the industry median in a given year; DIVYLD: Dividend yield, equal to dividends per share divided by share price for the firms that pay dividends, 0 otherwise. Parameter estimates are computed using logistic regression with fixed time and industry effects. We run a logit regression to estimate the propensity scores, based on the probability of having an overconfident CEO, conditional on all the control variables (based on Chen et al, 2020; Ben-David, et al., 2020; Schrand and Zeckman 2012; Ahmed and Duellman, 2013). For each firm-year observation with an overconfident CEO, we use the propensity scores obtained from the logistic regression to find a comparable firm-year observation with a non-overconfident CEO. Firms having an overconfident CEO are matched with the ones with a non-overconfident CEO employing the nearest-neighbor method, combined with one-on-one matching. We impose that the absolute

difference in propensity scores among pairs does not exceed 0.003³. Our results hold for both mean test and matched sample regression.

-----Please Include Table 7 around here-----

Discussion and Explanation

To put things in perspective, in this section we discuss possible explanations for our results. It is clear from our investigation that CEO overconfidence has a role in the life cycle stages and future performance of firm. Life cycle theory postulates that firms during their lifespan go through phases capturing distinct combination of external and internal characteristics. Since resource allocation and operational capabilities of firms vary from one life cycle stage to the other, firms at different stages of their life cycle are likely to face very different challenges and constraints. To deal with them, firms may need to adjust their strategies, organizational structures, and management styles. Thus, our findings reveal that “one size fit all” approach is not appropriate and is not feasible when it comes to top management styles. These findings imply that if firms can utilize the information provided by life cycle stages and adapt their top management style based on this information, they can improve their future performance. More specifically we find that CEO overconfidence has an enhancing impact on future firm performance specifically for firms in growth and mature stages. Both in the case of operating and market performance CEO overconfidence is quite beneficial for their firms and probably their investment strategies may work better than the others when firms have available internal resources to use.

Our results are in line with Habib and Hasan (2017) who assert that introduction and decline (growth and mature) stage firms take higher (lower) risks and the risk taking has negative (positive) future performance implications in introduction and decline (growth and mature) stages.

³ We use a relatively low caliper to ensure that the control variables are insignificantly different between treatment firms and control firms,

In turn, our study shows that having overconfident CEOs who are inclined to increase investment in risky projects (Hirshleifer et al. 2012) in firms at the stage of growth or maturity make these firms better off. Our findings complement previous theoretical research (Goel and Thakor 2008, Gervais et al. 2011, Campbell et al. 2011) suggesting that firms utilizing the right compensation schedule can motivate overconfident CEOs compared to other CEOs to pursue risky projects which in turn increases firm value along with the empirical research documenting that research and development investments in innovation and innovative success for these investments are greater for firms with overconfident CEOs (Hirshleifer et al. 2012).

One explanation for our findings for growth firms is that overconfident CEOs in growth firms concentrate on early investments such as research and development and aggressively acquire market share, deter competitor's entry into the market and increase operational efficiency (Jovanovic 1982, Selling and Stickney 1989) compared to their non-overconfident counterparts.

Even though firms at maturity stage have fewer investment opportunities compared to the ones at growth stage, they still need to invest to maintain their market share and to improve the production efficiency and profitability of operations (Jovanovic 1982, Selling and Stickney 1989, Wernerfelt 1985). These objectives can be better achieved if a firm is managed by an overconfident CEO who is inclined to increase R&D spending and productivity. However overconfident CEOs' investments are sensitive to cash flow. Prior literature documents that CEO overconfidence leads to greater risk taking, exploration, innovation, and investment if firms have sufficient internal funds. Since overconfident CEOs believe their company is undervalued, they prefer internal funds to external funds and are reluctant to issue equity to finance their projects. The availability of internal funds will allow them to invest more aggressively. CEO overconfidence does not matter in cases for lifecycle stages when firms need external financing such as introductory and decline

stages where cash flow from operation is negative. If the lifecycle of the firm is known (i.e., cash flows), the CEOs could be hired according to their overconfidence traits and levels.

VI. SUMMARY AND CONCLUSION

In this study we investigate the impact of CEO overconfidence and lifecycle stages on firms' performance. We test whether CEO Overconfidence and business life cycles affect the firms' net-operating profit and one year ahead excess return. We use an option-based overconfidence measure to identify overconfident CEOs based on Campbell et al. (2011), widely used in earlier literature. We use a cash-flow based lifecycle measure that is first proposed by Dickinson (2011). This measure has an advantage over earlier measures like age of the firm as it does not require a firm to transition sequentially. We find that companies in different life cycles with overconfident CEOs are more likely to perform better as measured by net-profit compared to companies with non-overconfident CEOs especially during growth, mature and shakeout stages but firms with overconfident CEOs in decline stage experience worse one year ahead accounting performance . Our results hold for both utilizing alternative overconfidence proxy measures and propensity score matching.

More interestingly, we also hypothesize and find that the association between CEO overconfidence and the company's stock return varies across firm's lifecycle stages. Specifically, CEO overconfidence positively related with abnormal return on growth and mature stages. Our results suggest that the firm's lifecycle stages play an important role in facilitating overconfident CEOs to execute the tone at the top that the CEO promotes. This strategy benefits firms with higher profitability and stock return.

Our study extends and contributes to the growing literature regarding the determinants of companies' firm performance by providing empirical evidence that both overconfident CEOs and

firm lifecycle play significant roles in firms' performance. We also explain how lifecycle stages could impact this association between CEO overconfidence and companies' accounting performances and stock returns.

Appendix #1: Variable Definitions

RNOA (PROFITABILITY)	Return on net operating assets which is calculated as Operating Income /Average Net Operating Assets.
FORWARD_ARNOA	Change in future RNOA
ARNOA	Change in current RNOA
GR_NOA	Growth in NOA which is calculated as (Net Operating Assets [NOA]/Lagged Net Operating Assets [NOA]) minus 1
ATO	Change in asset turnover (ATO)
ATO	Net Sales/Average Net Operating Assets
APM	Change in profit margin (pm)
PM	Profit margin which is calculated ad Operating Income (OI)/Net Sales
LC	Life Cycles are indicator variables set to 1 when the observation is in that life cycle category at the end of the current year, and 0 otherwise (Introduction, growth, mature, shake-out or decline).
CO (CEO OVERCONFIDENCE)	CO is an indicator variable set to 1 if the ratio of the options in-the-money exceeds 0.67 at least twice during the sample period, set to zero otherwise. A CEO is classified as overconfident starting from the first time their behavior meets the above requirements.
RESIDUAL HOLDER67	It is an indicator variable set to 1 if the residual of a regression of CEO Overconfidence (CO) on firm's annual stock return is greater than zero, set to zero otherwise.
HOLDER100	It is an indicator variable set to 1 if the ratio of the options in-the-money exceeds 1 at least twice during the sample period, set to zero otherwise.
HOLDER90	It is an indicator variable set to 1 if the ratio of the options in-the-money exceeds 0.9 at least twice during the sample period, set to zero otherwise.
BHAR	One-year ahead market-adjusted buy-and-hold return from the beginning of the fourth month of year t+1 through third month of year t+2 where market returns are value-weighted.
XSINVEST_INDADJ	The amount of excess investment in assets from the residual of a regression of total asset growth on sales growth run by industry-year
ACQUIRE_INDADJ	Net acquisitions from the statement of cash flows scaled by average total assets, adjusted for the industry median in a given year
DIVYLD	Dividend yield, equal to dividends per share divided by share price for the firms that pay dividends, 0 otherwise
XRD_INDADJ	R&D expenditures scaled by average total assets, adjusted for the industry median in a given year
CAPEX_INDADJ	Capital expenditures scaled by average total assets, adjusted for the industry median in a given year

Appendix #2: Hypotheses

Business Life Cycle Stage	Hypothesis	CEO Overconfidence Impact on Operating Performance	Hypothesis	CEO Overconfidence Impact on Market Performance
Introduction	1a	No impact: CEO overconfidence may not have impact	2a	No impact: CEO overconfidence may not have impact
Growth	1b	Positive: CEO overconfidence supports ambitious projects that can enhance profitability.	2b	Positive: Overconfidence can enhance stock performance through aggressive growth strategies and effective communication.
Maturity	1c	Positive: Overconfident CEOs can rejuvenate operations and drive profit margins beyond industry standards.	2c	Positive: Overconfidence can positively impact stock performance by leveraging stable operations and strategic asset optimization.
Shakeout	1d	Positive: CEO overconfidence can lead to innovative practices and strategic realignment, enhancing profitability.	2d	No impact: Overconfidence may not change the investor confidence during shakeout stage.
Decline	1e	Negative: Overconfident CEOs might implement strategies that may harm more the profitability.	2e	No impact: CEO overconfidence may not lead to improve stock performance through undecisive actions and ineffective recovery strategies.

Appendix #3: Life Cycle Stages

	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
<i>Predicted Sign</i>	<i>Introduction</i>	<i>Growth</i>	<i>Mature</i>	<i>Shake-Out</i>	<i>Shake-Out</i>	<i>Shake-Out</i>	<i>Decline</i>	<i>Decline</i>
<i>CFO</i>	-	+	+	-	+	+	-	-
<i>CFI</i>	-	-	-	-	+	+	+	+
<i>CFF</i>	+	+	-	-	+	-	+	-

Notes: CFO is Cash Flow from Operating Activities, CFI is Cash Flow from Investing Activities, and CFF is Cash Flow from Financing Activities.

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Table 1
Descriptive Statistics

VARIABLES	N	Mean	STD	Q1	Median	Q3
<i>Forward_ARnoa</i>	29,279	-0.008	0.321	-0.056	-0.001	0.049
<i>Rnoa</i>	29,279	0.121	0.347	0.046	0.105	0.189
<i>ARnoa</i>	29,279	-0.001	0.347	-0.055	0.000	0.049
<i>Gr_noa</i>	29,279	0.168	0.540	-0.039	0.054	0.207
<i>Aato</i>	29,279	0.004	1.260	-0.189	-0.002	0.151
<i>Apmt</i>	29,279	0.001	0.155	-0.025	0.001	0.026
<i>Introduction</i>	29,279	0.039	0.194	0.000	0.000	0.000
<i>Growth</i>	29,279	0.316	0.465	0.000	0.000	1.000
<i>Mature</i>	29,279	0.537	0.499	0.000	1.000	1.000
<i>Shakeout</i>	29,279	0.086	0.280	0.000	0.000	0.000
<i>Decline</i>	29,279	0.022	0.146	0.000	0.000	0.000
<i>CO</i>	29,279	0.531	0.499	0.000	1.000	1.000

Notes: Variable Definitions are in the appendix.

Table 2
Correlations

<i>VARIABLES</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>	<i>11</i>	<i>12</i>
<i>1. Forward_ΔRnoa</i>	1											
<i>2. Rnoa</i>	-0.444***	1										
<i>3. ΔRnoa</i>	-0.273***	0.406***	1									
<i>4. Gr_noa</i>	-0.128***	0.114**	-0.017**	1								
<i>5. Δato</i>	0.0173***	0.044***	0.327***	-0.337***	1							
<i>6. Δpm</i>	-0.187***	0.255***	0.590***	0.0407***	0.117***	1						
<i>7. Introduction</i>	0.061***	-0.227***	-0.044***	0.077***	-0.000	-0.029***	1					
<i>8. Growth</i>	-0.038***	0.018**	-0.009	0.248****	-0.062***	-0.019**	-0.137***	1				
<i>9. Mature</i>	-0.002	0.138***	0.024***	-0.211***	0.035***	0.015**	-0.217***	-0.732***	1			
<i>10. Shakeout</i>	-0.003	0.005	0.024***	-0.082***	0.029***	0.022***	-0.062***	-0.209***	-0.330***	1		
<i>11. Decline</i>	0.053***	-0.233***	-0.040***	-0.013**	0.022**	0.006	-0.030***	-0.102***	-0.161***	-0.046***	1	
<i>12. CO</i>	-0.028***	0.129***	0.010*	0.108***	-0.017**	0.004	-0.012**	0.084***	-0.030***	-0.054***	-0.046***	1

*, **, *** indicate coefficients that are significant at 10 percent, 5 percent, and 1 percent levels respectively.

Table 3
**Proportion of Observations in each RNOA Decile across Life Cycle
 Stages for overconfident CEOs**

	Pooled	Introduction	Growth	Mature	Shakeout	Decline
N	15,540	574	5,484	8,127	1,114	241
% of total N	100%	3.69%	35.29%	52.30%	7.17%	1.55%
RNOA Decile						
Lowest	50.00	8.84	5.17	18.04	66.80	
2	11.32	12.33	8.45	10.23	4.98	
3	6.45	12.38	9.04	7.72	7.05	
4	7.14	11.42	10.04	5.66	3.32	
5	5.40	10.67	10.56	6.28	4.15	
6	5.40	9.88	11.09	6.46	3.32	
7	6.79	9.19	11.48	6.73	1.24	
8	3.83	7.86	12.18	9.61	1.66	
9	1.92	8.32	11.74	11.67	1.24	
Highest	1.74	9.12	10.25	17.59	6.22	
Total	100%	100%	100%	100%	100%	

Table 4
Life Cycle, CEO Overconfidence and Profitability

VARIABLES	Forward ΔR_{noa}
<i>RNOA</i>	-0.383 -21.57***
<i>ΔR_{noa}</i>	-0.111 -5.52***
<i>Gr_noa</i>	-0.0289 -4.16***
<i>Δato</i>	0.015 3.55***
<i>Δpm</i>	-0.0419 -1.32
<i>Introduction</i>	-0.0224 -0.82
<i>Growth</i>	0.0155 0.81
<i>Mature</i>	0.0283 1.5
<i>Shakeout</i>	0.0146 0.73
<i>Decline</i>	-0.0114 -0.35
<i>Introduction × CO</i>	0.00193 0.06
<i>Growth × CO</i>	0.0202 3.52***
<i>Mature × CO</i>	0.0289 7.45***
<i>Shakeout × CO</i>	0.029 2.11**
<i>Decline × CO</i>	-0.17 -2.65***
<i>Year fixed effects</i>	yes
<i>Industry fixed effects</i>	yes
Number of Observations	29,279
R-squared (%)	0.24
R_Square_Adjusted (%)	0.237

Notes: *, **, *** indicate coefficients that are significant at 10 percent, 5 percent, and 1 percent levels respectively.
All t-statistics below the coefficients are adjusted for clustering by firm. The sample period is from 1992 to 2022.
All the continuous variables are winsorized at the 1st and 99th percentiles. We suppress the coefficients on the variable indicating CEO overconfidence because this variable is a linear combination of the variables indicating lifecycle stages.

Table 5
Life Cycle, CEO Overconfidence and Stock Return

VARIABLES	BHAR
<i>RNOA</i>	-0.0724 -5.90***
<i>ΔRnoa</i>	0.0407 2.50**
<i>Gr_noa</i>	-0.0235 -3.40***
<i>Δato</i>	-0.00436 -1.38
<i>Δpm</i>	-0.129 -4.39***
<i>Introduction</i>	-0.0421 -0.55
<i>Growth</i>	-0.0554 -0.78
<i>Mature</i>	-0.0442 -0.62
<i>Shakeout</i>	-0.037 -0.52
<i>Decline</i>	0.0525 0.66
<i>Introduction × CO</i>	0.0177 0.47
<i>Growth × CO</i>	0.034 3.59***
<i>Mature × CO</i>	0.0255 4.22***
<i>Shakeout × CO</i>	0.0182 1.05
<i>Decline × CO</i>	-0.0344 -0.63
<i>Year fixed effects</i>	yes
<i>Industry fixed effects</i>	yes
Number of Observations	29,158
R-squared (%)	0.089
R_Square_Adjusted (%)	0.0855

Notes: *, **, *** indicate coefficients that are significant at 10 percent, 5 percent, and 1 percent levels respectively. All t-statistics in parentheses are adjusted for clustering by firm. The sample period is from 1992 to 2022. All the continuous variables are winsorized at the 1st and 99th percentiles. We suppress the coefficients on the variable indicating CEO overconfidence because this variable is a linear combination of the variables indicating lifecycle stages.

Table 6
Panel A: Alternative Measures of CEO Overconfidence

VARIABLES	holder100		holder90		residual holder67	
	Forward ΔRnoa	BHAR	Forward ΔRnoa	BHAR	Forward ΔRnoa	BHAR
<i>RNOA</i>	-0.383 -21.60***	-0.072 -5.85***	-0.383 -21.57***	-0.072 -5.87***	-0.380 -21.61***	-0.073 -5.93***
<i>Arnoa</i>	-0.111 -5.52***	0.041 2.50**	-0.111 -5.52***	0.041 2.51**	-0.105 -5.23***	0.042 2.55**
<i>Gr_noa</i>	-0.029 -4.21***	-0.023 -3.38***	-0.029 -4.20***	-0.024 -3.41***	-0.029 -4.29***	-0.023 -3.38***
<i>Aato</i>	0.015 3.53***	-0.004 -1.380	0.015 3.55***	-0.004 -1.380	0.014 3.21***	-0.004 -1.400
<i>Apn</i>	-0.043 -1.340	-0.129 -4.42***	-0.043 -1.330	-0.129 -4.42***	-0.046 -1.460	-0.130 -4.42***
<i>Introduction</i>	-0.035 -1.360	-0.041 -0.550	-0.028 -1.080	-0.043 -0.570	-0.019 -0.710	-0.043 -0.560
<i>Growth</i>	0.018 0.950	-0.053 -0.750	0.018 0.960	-0.055 -0.770	0.020 1.090	-0.058 -0.820
<i>Mature</i>	0.029 1.570	-0.045 -0.630	0.029 1.560	-0.047 -0.660	0.033 1.82*	-0.046 -0.650
<i>Shakeout</i>	0.016 0.840	-0.029 -0.410	0.016 0.810	-0.030 -0.420	0.017 0.900	-0.039 -0.550
<i>Decline</i>	-0.038 -1.230	0.042 0.530	-0.035 -1.100	0.040 0.510	-0.010 -0.290	0.056 0.700
<i>Introduction × CO</i>	0.028 0.830	0.011 0.290	0.012 0.350	0.016 0.430	-0.004 -0.110	0.018 0.480
<i>Growth × CO</i>	0.017 2.93***	0.031 3.24***	0.016 2.89***	0.032 3.41***	0.021 3.71***	0.036 3.74***
<i>Mature × CO</i>	0.032 7.84***	0.028 4.45***	0.030 7.72***	0.031 5.05***	0.029 7.57***	0.026 4.29***
<i>Shakeout × CO</i>	0.028 1.79*	-0.010 -0.540	0.028 1.92*	-0.005 -0.290	0.030 2.22**	0.020 1.150
<i>Decline × CO</i>	-0.134 -1.86*	-0.020 -0.360	-0.134 -1.94*	-0.012 -0.220	-0.162 -2.55**	-0.047 -0.830
<i>Year fixed effects</i>	yes	yes	yes	yes	yes	yes
<i>Industry fixed effects</i>	yes	yes	yes	yes	yes	yes
<i>Number of Observations</i>	29,279	29,158	29,279	29,158	29,130	29,130
<i>R-squared (%)</i>	0.240	0.089	0.239	0.089	0.239	0.089
<i>R Square Adjusted (%)</i>	0.237	0.086	0.237	0.086	0.236	0.086

Notes: *, **, *** indicate coefficients that are significant at 10 percent, 5 percent, and 1 percent levels respectively. All t-statistics in parentheses are adjusted for clustering by firm. The sample period is from 1992 to 2022. All the continuous variables are winsorized at the 1st and 99th percentiles. We suppress the coefficients on the variable indicating CEO overconfidence because this variable is a linear combination of the variables indicating lifecycle stages.

Table 6
Panel B: Subsample Analysis

VARIABLES	Introduction		Growth		Mature		Shake-out		Decline	
	Forward Δrnoa	BHAR	Forward Δrnoa	BHAR	Forward Δrnoa	BHAR	Forward Δrnoa	BHAR	Forward Δrnoa	BHAR
<i>RNOA</i>	-0.382 -6.54***	-0.109 -1.91*	-0.479 -15.24***	-0.044 -1.84*	-0.245 -8.62***	-0.057 -3.07***	-0.437 -10.74***	-0.113 -3.19***	-0.448 -7.49***	-0.041 -0.880
<i>Arnoa</i>	-0.070 -1.080	0.096 1.82*	-0.099 -2.99***	0.019 0.620	-0.211 -5.88***	0.043 1.540	-0.144 -3.08***	0.062 1.560	-0.042 -0.560	-0.001 -0.010
<i>Gr_noa</i>	0.045 1.370	-0.007 -0.240	-0.022 -2.98***	-0.043 -4.66***	-0.119 -8.21***	-0.002 -0.140	-0.023 -1.270	-0.011 -0.670	0.096 2.42**	-0.009 -0.220
<i>Aato</i>	0.025 1.480	-0.005 -0.390	0.022 2.89***	-0.006 -0.950	0.020 2.72***	-0.003 -0.650	0.005 0.440	-0.006 -0.840	0.015 0.840	0.004 0.250
<i>Apmt</i>	0.142 1.460	-0.066 -0.680	-0.002 -0.040	-0.125 -2.19**	-0.002 -0.050	-0.266 -5.35***	-0.055 -0.670	-0.067 -0.940	-0.247 -1.91*	0.023 0.200
<i>CO</i>	-0.006 -0.190	0.035 0.870	0.030 4.79***	0.035 3.67***	0.024 6.51***	0.022 3.48***	0.031 2.09**	0.019 1.010	-0.178 -2.53**	0.011 0.180
<i>Intercept</i>	-0.079 -0.610	-0.330 -1.98**	0.017 0.570	-0.099 -0.930	0.023 0.920	0.030 0.430	0.017 0.380	0.062 0.670	-0.012 -0.080	-0.499 -1.630
<i>Year fixed effects</i>	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
<i>Industry fixed effects</i>	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
<i>Number of Observations</i>	1,145 0.235	1,126 0.182	9,260 0.292	9,228 0.078	15,718 0.224	15,684 0.087	2,518 0.340	2,495 0.126	638 0.325	625 0.227
<i>R-Squared (%)</i>	0.172	0.116	0.285	0.069	0.219	0.081	0.315	0.093	0.229	0.114
<i>R_Square_Adjusted (%)</i>										

Notes: *, **, *** indicate coefficients that are significant at 10 percent, 5 percent, and 1 percent levels respectively. All t-statistics in parentheses are adjusted for clustering by firm. The sample period is from 1992 to 2022. All the continuous variables are winsorized at the 1st and 99th percentiles.

Table 7
Propensity Score Matching
Panel A: Estimating the Propensity Scores

VARIABLES	Estimate	Wald	
		Chi-Square	Pr > Chi^{Sq}
Intercept	0.2554	1.1498	0.2836
XSINVEST_INDADJ	0.3541	32.7662	<.0001
CAPEX_INDADJ	3.7753	148.034	<.0001
XRD_INDADJ	0.221	0.6594	0.4168
ACQUIRE_INDADJ	1.2396	44.4746	<.0001
DIVYLD	-30.2965	896.906	<.0001
<i>Year fixed effects</i>	yes		
<i>Industry fixed effects</i>	yes		
Number of Observations	29,279		
Pseudo R-squared	0.0997		

Panel B: Descriptive statistics of the matched sample

	Firms with a non-overconfident CEO		Firms with overconfident CEO		Differences		
	N	Mean	N	Mean	Mean	t-value	p-value
XSINVEST_INDADJ	9,854	-0.013	9,854	-0.010	-0.003	-0.83	0.4041
CAPEX_INDADJ	9,854	0.007	9,854	0.007	0.000	0.34	0.7302
XRD_INDADJ	9,854	0.012	9,854	0.011	0.001	1.6	0.1092
ACQUIRE_INDADJ	9,854	0.026	9,854	0.026	-0.001	-0.58	0.5639
DIVYLD	9,854	0.009	9,854	0.009	0.000	-1.14	0.2556

Variable definitions are in the appendix. For each firm-year observation with an overconfident CEO, we use the propensity scores obtained from the logistic regression to find a comparable firm-year observation with a non-overconfident CEO. Firms having an overconfident CEO are matched with the ones with a non-overconfident CEO employing the nearest-neighbor method, combined with one-on-one matching. We impose that the absolute difference in propensity scores among pairs does not exceed 0.003.

Table 7

Panel C: Life Cycle, CEO Overconfidence and Profitability using Matched Sample

VARIABLES	Forward Δrnoa
<i>RNOA</i>	-0.382 -16.97***
<i>Arnoa</i>	-0.113 -4.78***
<i>Gr_noa</i>	-0.035 -3.79***
<i>Δato</i>	0.015 2.62***
<i>Δpm</i>	-0.064 -1.68*
<i>Introduction</i>	-0.049 -1.540
<i>Growth</i>	-0.017 -0.830
<i>Mature</i>	-0.003 -0.140
<i>Shakeout</i>	-0.014 -0.630
<i>Decline</i>	-0.030 -0.820
<i>Introduction × CO</i>	0.003 0.080
<i>Growth × CO</i>	0.031 4.25***
<i>Mature × CO</i>	0.029 6.29***
<i>Shakeout × CO</i>	0.031 1.90*
<i>Decline × CO</i>	-0.186 -2.45**
<i>Year fixed effects</i>	yes
<i>Industry fixed effects</i>	yes
Number of Observations	19,708
R-squared (%)	0.234
R Square Adjusted (%)	0.23

Notes: *, **, *** indicate coefficients that are significant at 10 percent, 5 percent, and 1 percent levels respectively. All t-statistics in parentheses are adjusted for clustering by firm. The sample period is from 1992 to 2022. All the continuous variables are winsorized at the 1st and 99th percentiles. We suppress the coefficients on the variable indicating CEO overconfidence because this variable is a linear combination of the variables indicating lifecycle stages.

FIGURE 1

