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How CEO/CMO characteristics affect innovation and stock returns:

Findings and future directions

Abstract

Investor stock market response has received a great deal of attention in marketing literature. However, firms are not faceless corporations; individuals such as CEOs set their strategies. Upper echelon and strategic leadership theories hold that chosen strategies derive from these individuals' opinions, which are a function of their personalities, demographics, experiences, and values. Building on recent literature, the authors propose how CEO characteristics can influence innovation and stock returns. Investors are motivated by cash flow expectations—in particular, the prospect of increasing and accelerating future cash flows, reducing associated risks, and increasing residual value. This systematic review focuses on four main characteristics—personality, demographics, experience and compensation—to arrive at a set of propositions on innovation and stock returns. After reviewing the extensive literature on CEO characteristics, the authors outline the emerging findings on CMO characteristics; propose future research directions on CEO and CMO characteristics, innovations, and stock returns; and offer implications for practice.

Keywords Stock returns, CEO, CMO, Personality, Demographics, Experience, Compensation, Innovation

Introduction

A small group of executives at the top of an organization (i.e., the top management team [TMT]¹) can dramatically affect firm outcomes (Kashmiri and Mahajan 2017; Nath and Bharadwaj 2020; Srinivasan and Hanssens 2009). A firm's CEO determines many strategic firm decisions, including major market entry and exit, innovations, and resource allocations (Brower and Nath 2018; Hambrick and Mason 1984; Kashmiri et al. 2017). Ample managerial evidence shows that the trajectories and fortunes of companies are traceable to the actions (or inaction) of their top executives. This intuition is formalized in the upper echelon theory in management (Hambrick 2007; Hambrick and Mason 1984), which argues that organizations are reflections of top managers' cognitions, values, and personalities. It is complemented by the model of strategic leadership (Finkelstein and Hambrick 1996; Finkelstein et al. 2009), which attributes organizational outcomes to decisions made by senior executives (Cannella and Monroe 1997). The basic argument in both these research streams is that the way senior executives view opportunities and challenges and how they process and interpret the information they receive are shaped by their values, personalities, and cognitions (Cannella and Monroe 1997).

At the same time, a third stream of research has focused on senior executive motivation and rewards (Carpenter and Sanders 2002; Finkelstein and Hambrick 1988) and, in particular, on the link among rewards, executive behavior, and firm outcomes. Using agency theory as the basis, researchers have analyzed how various aspects of fixed and variable compensation affect CEO and TMT strategic decisions. The main idea in this stream is that organizations can use

¹ Strategic leadership theorists have defined the term "top management team" as a relatively small group of the most influential executives at the apex of an organization—usually the CEO (or general manager) and those who report directly to him or her (Finkelstein et al. 2009).

compensation to align the incentives of key decision makers, specifically the CEO, with shareholders.

Our review of this literature reveals three critical points. First, while the *personality* of senior leaders and TMT *compensation* dominate the strategic leadership and finance/accounting literature, respectively, recent studies show how senior executives' *demographics* and *experience* influence the performance of their firms (Boal and Hooijberg 2001; House et al. 2014). Together, these characteristics represent internal (personality, demographics, and experience) and external (compensation) factors. They vary in the extent of *controllability* by the board: for example, a board can select a CEO on experience, an observable measure, more readily than on his or her personality, which is less observable. Second, current empirical findings are rich on the CEO but not on other TMT members. Likewise, the strategic leadership literature has tended to focus on TMTs without distinguishing between the CEO as a leader and other senior executives. We account for this distinction by focusing our review of findings on CEOs, while proposing specific future research on both the CEO and chief marketing officer (CMO), the executive in charge of the marketing function in the firm. Third, TMT research has appeared in a broad set of domains, including marketing, management, finance, accounting, and economics. This proliferation of TMT research in diverse academic fields has resulted in a large body of literature that lacks integration and synthesis across disciplines. In addition, there is a need for an agenda with respect to future research directions.

Stock return² response is our primary outcome variable and is a key performance metric in the general marketing–finance research stream (e.g., Srinivasan and Hanssens 2009). Stock returns are related to cash flow expectations—in particular, the prospect of increasing and accelerating future cash flows, reducing associated risks, and increasing residual value (Srivastava et al. 1998). We therefore use cash flow expectations, when feasible, to motivate the effect of CEO characteristics on stock returns. While CEOs have many pathways through which to manage cash flows, one variable that has received a great deal of attention in extant literature is innovation³ (e.g., Barker and Mueller 2002; Galasso and Simcoe 2011; Kashmiri et al. 2017). Because our research is based on a systematic review of extant literature, we use innovation as the second focal variable. Successful CEOs and CMOs achieve innovation, a key driver of stock returns, typically by focusing on new products and R&D (Lehmann 2015; Warren and Sorescu 2017; Yadav et al. 2007; Zahra and Pearce 1989), and we expect that lower-level managers will adjust their preferred level of innovation accordingly (e.g., Rubera and Kirca 2012). The litmus test of a relationship between top management incentives/characteristics and innovation is (1) how much actual innovation the firm develops for the market (e.g., Pauwels et al. 2004) and (2) how valuable that innovation is, which can be captured by, among other factors, the stock returns associated with this innovation (e.g., Srinivasan et al. 2009). We acknowledge that innovation is just one of the intervening variables in assessing the impact of CEO characteristics on stock returns, but other intervening variables (e.g., emotional intelligence, leadership) are not systematically reported in the literature we reviewed to offer propositions on them.

² Stock returns reflect the change in the total value of an investment in a common stock over some period per dollar of initial investment (e.g., Srinivasan and Hanssens 2009) and is operationalized as $(Price_t + Dividend_t - Price_{t-1}) / (Price_{t-1})$.

³ Innovation refers to the process of bringing new products and services to market (Hauser et al. 2006).

Because the routes by which CEO characteristics affect stock returns are important, we offer three types of propositions: CEO characteristics as directly linked to stock returns, CEO characteristics as indirectly linked to stock returns through innovation as a mediator, and innovation as a moderator on stock returns. For the propositions in which CEO characteristics are *directly* linked to stock returns, rather than simply reporting the *direct* empirical relationship from previous studies, we use four mechanisms noted above (Srivastava et al. 1998) to provide a theory-driven and logical framework for organizing and presenting the disparate set of other intervening variables.

To address the recent call for *generalizations in marketing* from the *Journal of the Academy of Marketing Science*, we undertake this review to fill the gap in marketing literature regarding “what we know” and “what we need to know” about the TMT–innovation and TMT–stock returns relationships. Specifically, we synthesize the literature and arrive at a set of propositions that capture extant knowledge in this area. While doing so, we also extend findings for CEOs to CMOs (on whom research is limited), using what we learn from our synthesis of the existing CEO/TMT literature (e.g., the categories of personality, demographics, experience, and compensation) to inspire a fresh research agenda for CMO research, and importantly we propose how the focal variables may influence CMO decision making.

Our research offers several contributions to both academia and practice. First, we integrate the literature on the four different CEO characteristics (personality, demographics, experience, and compensation) and examine how they drive innovation and stock return impact. Through our synthesis of the literature, we provide 10 propositions that summarize the state-of-the-art in the literature on this topic, as well as identify gaps in the literature. Second, we extend

existing research to CMOs and offer specific areas for future research. We advance knowledge on the role of marketing in the firm, guide scholars on how to approach CMO issues, and provide specific suggestions on potential hypotheses and analysis. Third, we offer specific advice on how to measure TMT characteristics beyond those of CEOs across many companies and industries.

For managers, our research is relevant for three reasons. First, their understanding of TMT characteristics helps them influence innovation decisions, with direct implications on how to advocate for innovation projects and budgets. Second, the identified tradeoff between returns and risks helps them assess the likely innovation and firm value changes from a change in the TMT. Third, the study's findings provide managerial guidance on TMT recruitment and retention, accounting for personality, demographics, experience, and compensation. We also highlight when managers are likely to benefit from refuting common wisdom, including how to better anticipate how their own characteristics might help or hinder their performance.

Synthesizing the TMT literature

To accomplish our study's goals, we synthesized the TMT literature from 2000 to 2018 following the general procedure in previous systematic reviews (e.g., Cleeren et al. 2017; Pelozo and Shang 2011). First, we conducted an issue-by-issue search of publications on the relationship between CEO/CMO/TMT and innovation/stock returns from major marketing journals and leading journals in related fields, such as management, accounting, finance, and economics, on the UT Dallas top journal list (see Web Appendix 1 for the full list). Second, given the structure that emerged from the literature for our theoretical framework, we used keyword searches (e.g., "TMT/CEO/CMO overconfidence," "sensation seeking," "military background," "political ideology," "facial traits," "narcissism," "future attention focus," "strategic leadership," "age," "education," "gender," "socioeconomic origin," "tenure," "functional expertise," "networks,"

“duality,” “compensation,” and “innovation/stock returns”) in several electronic databases such as ABI/INFORM, Business Source Premier, Google Scholar, and Social Science Research Network to better identify articles pertinent to our study. Finally, we reviewed the reference list in all the obtained articles.

We included articles using two criteria. First, we included articles that empirically examine how TMT/CEO/CMO personality, demographics, experience, and compensation affect innovation. Second, we focused on studies that explore the stock return impact associated with CEO characteristics through innovation and other intervening variables, in particular the prospect of increasing and accelerating future cash flows, reducing associated risks, and increasing residual value (Srivastava et al. 1998). We therefore excluded studies that focus solely on firm revenue and/or profit in the TMT literature—those few articles are included in Web Appendix 2. Our search resulted in 170 articles. Fig. 1 shows the number of articles by journal and field.

--- Insert Figure 1 about here ---

We proceed as follows. We briefly explain our conceptual framework and the procedure followed to arrive at our propositions. For each variable in each category, we identify articles that examine the impact of the focal variables on either innovation or stock returns. We then synthesize the findings in the literature to arrive at a set of propositions on the impact of the relevant focal variables on innovation and stock returns. Drawing on these propositions, we identify gaps in the literature and propose a rich agenda for future research.

Conceptual framework: CEO characteristics and innovation/stock returns

Within any organization, the “levers of power are uniquely concentrated in the hands of the CEO” (Nadler and Heilpern 1998, p. 9). The marketing, management, and finance literature

acknowledge that CEO characteristics explain organizational outcomes (Boyd and Kannan 2018; Hambrick and Mason 1984; Warren et al. 2019). CEOs have the power, and arguably even the obligation, to set the direction of the firm (see Hambrick and Mason 1984). They often have considerable discretion to define the strategic orientation of the firm, and innovation often plays a key role in shaping and realizing those strategies. In keeping with this theory, researchers in a variety of management fields (e.g., strategy, finance, marketing) have investigated the potential impact of several variables that may affect TMT behavior, innovation, and, thus, firm performance (Hambrick and Mason 1984). Fig. 2 shows our framework, based on a review of the literature and an analysis of the variables commonly used.

--- Insert Figure 2 about here ---

On the left-hand side of Fig. 2, we classify the variables most commonly examined in the literature into four key categories, which capture both internal and external factors. First, CEOs' *personality* traits can affect their choices and, thus, organizational performance (Hambrick and Mason 1984). CEO personality characteristics that we consider include overconfidence, sensation seeking, military background, and political ideology. Second, *demographics* matter (Hambrick and Mason 1984) and have the advantage of straightforward measurement. We focus on three demographic characteristics: age, education, and gender. Third, *experience* captures the background characteristics that provide much of the knowledge and values the CEO brings to bear on judgments and decisions that affect firm strategy. We include tenure and functional expertise as main indicators of experience. While these three categories can be considered internal characteristics of an executive, our last category captures the firm's input in incentivizing the optimal decisions from its TMT—*compensation*. Our four categories, therefore, are comprehensive in capturing the internal and external factors likely to influence CEO decision making.

On the right-hand side of Fig. 2, we highlight our key dependent variable: stock returns. In the middle of the figure, the variable innovation mediates the relationship between CEO characteristics and stock returns through the indirect route. We are interested in innovation because it is one of the main intervening variables through which CEO characteristics affect firm performance (as reflected in stock returns). The figure also shows that CEO characteristics can be linked to stock returns without having an effect on innovations. In the source articles reviewed, we found that multiple intervening variables affect the relationship between CEO characteristics and stock returns. For example, in the CEO education–stock return relationship, emotional intelligence, leadership, and network could be intervening factors. In essence, there are dozens of such intervening variables other than innovation across the studies we analyze that affect stock returns. Furthermore, few of these variables feature in enough articles to generalize their effects. Therefore, we incorporate into our conceptual framework the mechanisms in Srivastava et al. (1998) that drive shareholder value: (1) an increase in the level of cash flows, (2) an acceleration of cash flows, (3) a reduction in risk associated with cash flows, and (4) the residual value of the business. First, CEO characteristics can translate into firm strategies that can enhance shareholder value by growing the level of cash flows (i.e., more cash), by increasing revenues and lowering costs. For example, firms with financially conservative CEOs might generate increased cash flows from reduced expenses that boost the firm’s bottom-line performance. Second, CEO characteristics that result in firm strategies that help accelerate the receipt of cash flows (i.e., faster cash) can enhance a firm’s shareholder value. For example, CEO characteristics and traits associated with the exploration of new, high-growth markets may result in accelerating the firm’s cash flows. Third, CEO actions can increase shareholder value by reducing the vulnerability and volatility of these cash flows (i.e., safer cash), which results in

a lower cost of capital or discount rate (Srivastava et al. 1998). Thus, all else being equal, cash flows that are stable have a higher net present value and thus create more shareholder wealth. For example, experienced CEOs may have a broader knowledge base and richer skillsets to draw on to handle demand uncertainties, which may help smooth out the variability in cash flows. Fourth, CEO characteristics may increase the residual value of the firm. For example, CEOs with marketing functional expertise may be uniquely qualified to build differentiated brands that can increase the equity of the brands and, thus, the firm's residual value. We therefore argue that CEO characteristics can help increase, accelerate, and stabilize the firm's cash flows and increase its residual value through a direct link, thus influencing the outlook of investors. Together, we offer three types of propositions on CEO characteristics that (1) have innovation as a moderator on stock returns, (2) are indirectly linked to stock returns through innovation as a mediator, and (3) are directly linked to stock returns through other variables.⁴

CEO personality

A quickly growing research stream links CEO personality characteristics with innovation. However, surprisingly few articles link CEO personality to stock returns, as we show in Table 1.

--- Insert Table 1 about here ---

Overconfidence Overconfidence refers to the tendency of individuals to believe they are better than they really are in terms of, for example, ability, judgment, or gauging the prospects of a successful outcome (Hirshleifer et al. 2012). This trait is highly applicable to TMTs because

⁴ We consider both the direct and indirect effect through innovation on stock returns of CEO characteristics (see, e.g., Rubera and Kirca 2012; Srinivasan et al. 2009; Warren and Sorescu 2017; Warren et al. 2019). We do not assume that the stock market immediately and fully incorporates all future cash flows that will derive from a CEO's particular characteristics at the moment his or her appointment is announced. Thus, stock returns may adjust over time as the market processes the implications of various CEO factors. In general, we build our propositions around the idea of semistrong stock market efficiency (Fama 1970), in which the stock market adjusts to all available information, but not instantaneously.

overconfidence increases with individual skill (Camerer and Lovallo 1999) and complexity in the relationship between actions and outcomes (Moore and Kim 2003). With the exception of Stock et al. (2019), previous studies have found that CEO overconfidence is positively related to innovation (e.g., Galasso and Simcoe 2011; Hirshleifer et al. 2012; Malmendier and Tate 2005; Simon and Houghton 2003). For example, Galasso and Simcoe (2011) document that companies with an overconfident CEO have more citation-weighted patents. Likewise, Hirshleifer et al. (2012) find that overconfident CEOs invest more in innovation and obtain more patents and patent citations. Literature also shows that overconfident individuals may overestimate the expected future returns and underestimate the likelihood of failure from uncertain endeavors, because they tend to overestimate their own ability to control situations and make optimal decisions (Griffin and Tversky 1992; Langer 1975; Simon and Houghton 2003; Weinstein 1980). It follows that overconfident CEOs are more willing to initiate innovation-related activities. Thus:

P1a: CEO overconfidence is positively related to innovation.

At the same time, the literature implies a direct negative effect of overconfidence on stock returns because overconfident individuals engage in more uncertain endeavors, thus increasing cash flow volatility. Malmendier and Tate (2005) document that overconfident CEOs tend to engage in unprofitable mergers and suboptimal investment behavior, which may result in deceleration of cash flows and reduction of the firm's residual value, thereby destroying firm value. Similarly, Doukas and Petmezas (2007) show that CEO overconfidence can lead to lower merger-and-acquisition announcement returns, with decreasing cash flows arising from poor long-term performance in these situations.

This direct negative effect competes with the indirect positive effect through innovation. Hirshleifer et al. (2012) show that overconfident CEOs are more willing to undertake risky but valuable innovation and are better at translating external opportunities into increased cash flows and, thus, firm value. CEO overconfidence generates value through greater exploration and risk taking, increasing cash flows, albeit with higher volatility of cash flows, and resulting in a favorable investor reaction (Bernardo and Welch 2001; Goel and Thakor 2008). Thus:

P1b: CEO overconfidence has an indirect positive relationship to stock returns through innovation.

P1c: CEO overconfidence has a direct negative relationship to stock returns.

Sensation seeking While overconfidence and risk taking tend to increase corporate innovation (Galasso and Simcoe 2011; Hirshleifer et al. 2012), they may not be sufficient for innovation success. Dyer et al.'s (2011) survey of 5,000 executives finds that successful innovators are constantly trying out new experiences and piloting new ideas. Prior studies highlight sensation seeking, defined as “the seeking of varied, novel, complex and intense sensations and experiences, and the willingness to take physical, social, legal, and financial risk for the sake of such experiences” (Zuckerman 1994, p. 27). Extant research has shown that sensation seekers are more likely to be innovative because they are creative, are open to new experiences, prefer changes, and dislike structured and repetitive situations (Mittelstaedt et al. 1976; Roberti 2004). For example, Sunder et al. (2017) show that firms led by sensation-seeking CEOs generate greater innovation outcomes, measured by patents and associated citations. Thus:

P2a: CEO sensation seeking is positively related to innovation.

Furthermore, literature has shown that the creativity and novelty-seeking characteristics of sensation-seeking CEOs imply proactive, nonroutine searches for new and innovative ideas and creation of new opportunities, which enhance product innovation to achieve higher and faster cash flows and financial performance (Cain and McKeon 2016). Consistently, Sunder et al. (2017) find that for the CEO, sensation seeking is associated with higher abnormal returns for patent announcements. They use CEOs' penchant for flying small aircrafts as a hobby to capture their innate desire for novel experiences that entail risk and find that pilot CEOs are associated with more successful and original innovation. In contrast with this evidence for a positive stock return impact through innovation, no research to our knowledge shows positive effects through other intervening variables. Thus:

P2b: CEO sensation seeking has an indirect positive relationship to stock returns through innovation.

Military background Service in the military may alter individuals' behavior in various ways that could affect their decisions and actions when they become CEOs later in life (Benmelech and Frydman 2015).⁵ Although psychology literature indicates that military service is associated with overconfidence, aggressiveness, and risk-taking behavior (Elder 1986; Elder and Clipp 1989; Elder et al. 1991), a few recent studies (e.g., Benmelech and Frydman 2015; Lin et al. 2018) find that firms run by military CEOs are less likely to innovate. For example, Benmelech and Frydman (2015) find that CEOs with a military background invest less in R&D and pursue less corporate investment. Consistently, Lin et al. (2018) show that firms led by military CEOs are associated with lower expenditures on R&D than their nonmilitary peers in China. This

⁵ Military background can be classified as either a personality or a demographic characteristic. We do not regard military background as a demographic characteristic because it is a former occupation for current CEOs. More important, research has treated military background as a "personality trait" because it is a proxy for conservatism and affects individuals' values, behaviors, and actions (e.g., Benmelech and Frydman 2015).

evidence can be explained by the argument that military training and service values subordination to political authority, duty, dedication, and self-sacrifice, which may lead to a corporate culture that encourages low risk taking and conservative investment behavior (Benmelech and Frydman 2015; Franke 2001). Thus:

P3a: CEO military background is negatively related to innovation.

Moreover, many studies have explored the relationship between executive military background and firm performance. Sunder et al. (2017) find that patent announcements by military background CEOs increase abnormal returns less than those by nonmilitary CEOs. In addition, Benmelech and Frydman (2015) show a negative main effect of military CEOs on firm performance, which turns nonsignificant after they account for an MBA degree. Lin et al. (2018) find a 3% lower return on sales for CEOs with versus without a military background. This is probably because conformity, discipline, and bureaucratic behavior, which are fostered in military service, discourage entrepreneurial behavior and innovativeness (Avrahami 2003), thus yielding lower and slower cash flows than firms led by nonmilitary CEOs. In summary, studies finding negative stock return effects all attribute these to lower innovation, while none have shown a direct negative effect that does not operate through innovation. Thus:

P3b: CEO military background has an indirect negative relationship to stock returns through innovation.

Political ideology Political ideology is a multidimensional concept, but many Americans identify themselves along the liberal–conservative continuum (for a review, see Jost et al. 2003). The political ideology of CEOs, which reflects their beliefs and values, influences their managerial actions and decisions (Chin et al. 2013). While liberal ideology goes hand-in-hand

with an openness to ambiguity and tolerance of change (Conover and Feldman 1981; Jost et al. 2003), political conservatism entails resistance to change and fear of uncertainty (Giddens 1998). As such, we expect politically liberal CEOs to exhibit greater innovation propensity than their politically conservative counterparts, which is strongly supported by the empirical findings. Behaviorally consistent with the basic tenets of conservative ideology, firms led by Republican-leaning CEOs have lower levels of R&D expenditures (e.g., Hutton et al. 2014) and lesser inclination to innovate (e.g., Kashmiri and Mahajan 2017) than firms led by Democratic-leaning CEOs. Thus:

P4a: CEO liberal ideology is positively related to innovation.

Several studies hypothesize and find that liberal CEOs' greater risk tolerance and openness to ambiguity are manifested in their strategic decisions, which accelerates cash flows but also increases cash flow volatility. Kashmiri and Mahajan (2017) document that firms led by Democratic-leaning CEOs have higher stock returns but also higher stock return volatility. Similarly, Unsal et al. (2016) find that compared with firms with Democrat CEOs, firms with Republican CEOs experience relatively poorer firm performance, more agency conflicts, and less increases in buy-and-hold abnormal returns.

For the direct stock returns effect, Republican CEO-led firms also show lower levels of corporate debt (Hutton et al. 2014) and a lower degree of tax avoidance (e.g., Christensen et al. 2015) than Democrat CEO-led firms. Controlling for the degree of innovation, such conservative management should increase cost-efficiency and thus increase cash flows and firm performance. However, Republican CEO-led firms also show lower emphasis on corporate social responsibility (e.g., Chin et al. 2013), which can reduce stock returns and stock return response

to owned social media (Colicev et al. 2018). Given these opposing effects, the jury is still out on the net direct effect of CEO ideology on stock returns. Thus:

P4b: CEO liberal ideology has an indirect positive relationship to stock returns through innovation.

CEO demographics

For demographic characteristics, we focus on CEOs' age, education, and gender. Table 2 provides an overview of research findings linking demographics to innovation and stock returns.

--- Insert Table 2 about here ---

Age Age is an important indicator of a person's experience. Previous research has investigated the relationship between the age of TMT executives and firms' innovation, and there is reasonable consensus that CEO age is negatively linked to innovation (e.g., Barker and Mueller 2002; Bertrand and Schoar 2003; Serfling 2014; Zhang and Sun 2017). For example, Barker and Mueller (2002) find that R&D expenditure is greater at firms with younger CEOs. Consistent with this, Serfling (2014) shows that older CEOs invest less in R&D. This may be because younger CEOs attempt to signal superior capability to the market by pursuing aggressive investments in innovation (Prendergast and Stole 1996). By contrast, older CEOs might have greater commitment to the status quo of the firm and more concerns about their own financial and career security and therefore are less willing to grasp new ideas for innovation (Hambrick and Mason 1984; Yim 2013). Moreover, they are slower in learning new technologies and less likely to seek growth through innovative strategies in an effort to seize perceived opportunities (Grund and Westergård-Nielsen 2008; Hambrick and Mason 1984). Thus:

P5a: CEO age is negatively related to innovation.

Regarding the relationship between CEOs' age and stock returns, the results from previous studies are mixed. For example, Morresi (2017) shows that CEO age is significantly negatively related to firm performance measured by return on assets (ROA), return on equity (ROE), and stock returns. Similarly, Serfling (2014) finds that firms managed by younger CEOs earn significantly higher risk-adjusted stock returns. Prior research shows that executives at a young age are more likely to challenge the status quo and report greater pressure for change in their companies, and thus they attempt to adopt novel and innovative approaches (Child 1975; Hambrick and Mason 1984). As discussed previously, innovation can accelerate cash flows, which in turn increase stock returns (Srinivasan et al. 2009; Warren and Sorescu 2017; Warren et al. 2019). Thus, we expect younger CEOs to be associated with greater stock returns, mediated by innovation.

Moreover, literature shows that CEO age has a direct positive relationship to stock returns without influencing innovation. Cheng et al. (2010) find that older top executives are more likely to generate higher cash flows, resulting in higher ROA and stock returns in Chinese companies. This is partly because older executives are more apt to strengthen cohesiveness among organization members, which consequently leads to greater efficiency in strategy execution. Firms with such CEOs may also garner higher firm residual value. Consistent with this, Nguyen et al. (2015) find that CEO age is positively and significantly associated with stock returns in the U.S. banking sector. From an organizational learning perspective, older CEOs may have richer work and life experiences to handle more complex and ambiguous business problems than younger CEOs, which could lead to stable cash flows and positively affect stock returns (Reed and DeFillippi 1990; Worthy et al. 2011). Given these arguments, we propose the following:

P5b: CEO age has a U-shaped relationship to stock returns, partially mediated by innovation.

Education Education can be a signal of a person's knowledge, skill base, and cognitive ability.

The level of education (i.e., amount of formal schooling), type of education (mainly MBA degree or others), and quality of education (the university's prestige) are the most important indicators of CEOs' educational background and have been linked to firm performance in the literature.

While Barker and Mueller (2002) find no association between the amount of education and firm innovation after a CEO has attained a college degree, other studies find that more innovative organizations are led by CEOs with higher levels of education (e.g., Camelo et al. 2010; Lin et al. 2011; Zhang and Sun 2017). For example, Camelo et al. (2010) find a positive relationship between top executives' education level and innovation, measured by the number of new/improved products and the number of registered patents. Similarly, Lin et al. (2011) show that CEO education level is positively associated with firms' R&D intensity. They argue that CEOs with a better education may have greater cognitive complexity, such that they are more capable of acquiring and processing complex information and can make decisions faster (Wally and Baum 1994). In addition, more educated CEOs may be more curious and open to novel concepts and more likely to be receptive to new ideas and changes (Kimberly and Evanisko 1981; Thomas et al. 1991).

Regarding the relationship between the type of education of CEOs (mainly MBA degree or others) and innovation, Barker and Mueller (2002) fail to find a significant association.

However, later studies such as those of Bertrand and Schoar (2003) and King et al. (2016) show that CEOs with an MBA degree choose riskier corporate strategies and innovative business models. This may be due to the likely positive effect of professional management training of

CEOs, obtained through an MBA degree, on the risk management and administrative complexity of firms (Hambrick and Mason 1984). Thus:

P6a: Both CEO education level and MBA degree are positively related to innovation.

Furthermore, several studies link the CEOs' education level to stock returns and show a direct positive relationship between them. For example, Cheng et al. (2010) find that firms with CEOs who possess a university degree or above achieve higher ROA and stock returns than CEOs who do not. They argue that CEOs' intellectual competence, which can stem from education, is an essential component in generating new managerial skills to achieve competitive advantages for their brands, leading to higher cash flows. In addition, CEOs with more prestigious educational backgrounds enjoy more "weak ties" to government officials and other key decision makers to conduct their business effectively (Gottesman and Morey 2006), and thus such backgrounds are an important human and social capital for the firm that also increases cash flows. Moreover, Goll et al. (2001) show that CEOs with a higher education level can generate better firm performance such as ROA, ROE, and earnings per share (EPS). Such CEOs may be more cognitively capable of processing information and dealing with unexpected circumstances, reducing cash flow vulnerability, raising residual value (Gottfredson 2003; Henderson and Fredrickson 1996), and ultimately resulting in more stable cash flows.

Regarding the association between executives' MBA degree and stock performance, whereas Nguyen et al. (2015) find that having an MBA degree does not affect firms' stock returns, several studies (e.g., Bertrand and Schoar 2003; Bhagat et al. 2010) document that firms led by CEOs with MBA degrees have higher stock returns. For example, Bhagat et al. (2010) find that when a CEO has an MBA degree from a top-20 business school, operating performance

improves, resulting in increased cash flows and, thus, higher stock returns and ROA. Relatedly, Bertrand and Schoar (2003) show that CEOs with an MBA degree are associated with ROA levels 1% higher than the levels for non-MBA graduates. MBA programs, in particular, provide CEOs with the most advanced skills in all areas of firm management (e.g., marketing, accounting, finance, strategic management) to handle administrative complexity and uncertainties, which reduces cash flow volatility. Such CEOs are also likely to be more responsive to the presence of growth opportunities, increasing the residual value of the firm. Moreover, CEOs with an MBA degree are likely to have better social connections to obtain more resources and opportunities, which may result in superior cash flows and, thus, firm performance. As such, we expect a direct positive relationship between CEOs' MBA degree and stock returns:

P6b: Both CEO education level and MBA degree have a direct positive relationship to stock returns.

Gender Extant studies report mixed findings regarding gender: female executives are positively (e.g., Yao 2015), negatively (e.g., Strohmeier et al. 2017), or not (e.g., Zhang and Sun 2017) associated with innovation. On the positive side, female CEOs can significantly promote firms' technological innovation (e.g., Yao 2015). In general, gender diversity can facilitate high levels of creativity and innovation (Hoffman and Maier 1961; Wiersema and Bantel 1992). TMTs are often overwhelmingly comprised of men, but female CEOs can bring more thorough information processing to TMTs and provide firms with diverse viewpoints and different methods to solve problems. Research has shown that, in general, women have superior skills to men in fostering the exchange of ideas and knowledge, resolving conflicts, adapting to changes, and motivating

and inspiring others, all of which are critical to innovation (Dezsö and Ross 2012; Krishnan and Park 2005).

By contrast, Strohmeier et al. (2017) show that firms led by women exhibit less innovation breadth and depth than those led by men. This finding receives support in studies in psychology/economics literature that find that women are more risk averse and less confident than men in making investment decisions (Bernasek and Shwiff 2001; Byrnes et al. 1999). In a similar vein, Faccio et al. (2016) document that transitions from male to female CEOs are associated with a significant decline in corporate risk taking and, thus, innovation outcomes.

Although research shows that highly competitive industries may generate more demand for innovations (Myers and Marquis 1969), to our knowledge no prior research has formally tested the industry difference in the effect of gender on innovation. However, one related study (Kalleberg and Leicht 1991) examines the effect of industry differences on the relationship between gender and organizational performance, such as survival and gross earnings. The authors find that none of the industry variables (i.e., size, change in size, and competition) were related to changes in earnings for either men or women. Thus, we provide two alternative propositions:

P7a: Female CEOs are positively associated with innovation.

P7b: Female CEOs are negatively associated with innovation.

Beyond innovation, research findings on the relationship between CEO gender and stock returns are also mixed. Researchers have found a positive (e.g., Jalbert et al. 2013; Khan and Vieito 2013; Moreno-Gómez et al. 2018; Peni 2014; Strøm et al. 2014), negative (e.g., Lee and James 2007), or nonsignificant (e.g., Nguyen et al. 2015) relationship between female CEOs and firm stock returns. For example, Jalbert et al. (2013) and Peni (2014) document that female CEOs have

a direct positive relationship to firms' ROA through their actions that increase cash flows and accelerate cash flows. Specifically, the "feminine management style," such as sharing information and power, encouraging participation and inputs from others, and providing contingent rewards (e.g., recognizing and praising others' good performance), may foster a supportive work environment, improving firm cash flows and growth (Eagly et al. 2003). Moreover, Peni (2014) argues that female CEOs can offer additional insights into building and maintaining relationship with consumers and business partners (Daily et al. 1999), resulting in more stable cash flows and residual value of cash flows (Srivastava et al. 1998). As such, female CEOs may improve firm stock returns.

Furthermore, Dezsö and Ross (2012) find that innovation positively moderates the effect of female CEOs on firm performance. A supportive argument suggests that female leaders help stimulate a broader discussion of divergent perspectives, which is valuable for tasks requiring creative solutions, such as the innovation process (Van Knippenberg et al. 2004). Female CEOs also prompt greater motivation and organizational commitment among lower-level female managers to participate in innovation-related activities (Dezsö and Ross 2012). Thus, female executives might be particularly beneficial for firms with an innovation focus.

However, Lee and James (2007) demonstrate the underperformance of female CEOs relative to their male counterparts. They find that announcements of female CEO appointments are directly associated with more negative stock market reactions than announcements of male CEOs. This is probably because female CEOs' differentiated transformational leadership (i.e., ability of leaders to vary their behavior on the basis of followers' individual differences and contextual factors) is more strongly negatively related to TMT effectiveness in terms of joint

decision making, which may decelerate cash flows and decrease cash flows (Zhang et al. 2015).

Given these arguments, we propose the following:

P7c: Female CEOs have a direct positive relationship to stock returns.

P7d: Innovation strengthens the positive relationship between female CEOs and stock returns.

P7e: Female CEOs have a direct negative relationship to stock returns.

CEO experience

We consider two main indicators of TMT experience: tenure and functional expertise. Table 3 provides an overview of research findings linking CEO experience to innovation and stock returns.

--- Insert Table 3 about here ---

Tenure CEOs act according to their understanding of the strategic situations they face (Hambrick and Mason 1984). This understanding is shaped by their tenure (e.g., Chen 2013), which reflects their skills, knowledge, and cognitive orientation (e.g., Barker and Mueller 2002). Studies of CEO tenure as a determinant of innovation provide mixed results. Some studies fail to find a significant relationship between CEO tenure and R&D spending (e.g., Barker and Mueller 2002; Daellenbach et al. 1999), while others document either a negative relationship (Balsmeier and Buchwald 2014) or an inverted U-shaped relationship (Chen 2013). Previous research has often argued that managers with no tenure in the organization (i.e., newly appointed managers) are better able to induce key strategic changes (Hambrick and Fukutomi 1991). For example, newly appointed managers from outside the organization lack an affinity to the status quo, which can spur them to enter new markets through the development of new products (Westphal and

Fredrickson 2001). Indeed, new CEOs tend to learn from and adapt to external environments by leveraging diverse market and customer-related information sources and championing product innovations (Luo et al. 2014). Consistent with this, Kor (2006) finds that the R&D intensity is greater for firms with CEOs with lower tenure.

As tenure increases, CEOs' receptivity to strategic changes declines (Henderson et al. 2006). At intermediate levels of tenure, for example, CEOs are less willing to assume risks and are constrained by prior successful routines, and as a result, they are less willing to invest in R&D (Chen 2013). With ongoing tenure, CEOs gain knowledge and experience, securing the reliance of shareholders, and thus may be able to initiate innovative projects (Balsmeier and Buchwald 2014). Simsek (2007) documents that CEO tenure indirectly influences performance through its direct influence on TMT risk-taking propensity and the firm's pursuit of entrepreneurial initiatives. Boeker (1997) finds that TMT tenure is positively associated with higher levels of strategic change. These arguments support a U-shaped relationship. Thus:

P8a: CEO tenure has a U-shaped relationship to innovation.

CEOs early in their tenure tend to learn rapidly and are willing to take risks for superior payoffs. By examining a sequence of nested models, Simsek (2007) finds that CEO tenure improves firm performance measured through metrics such as increases in cash flows and growth in market share, but not stock returns. Thus, prior research has not assessed the impact of CEO tenure indirectly through innovations on stock returns.

Regarding the direct effect, CEOs with shorter tenure have greater firm performance improvements than CEOs with longer tenure (Huson et al. 2004); the increases in cash flows stem from the improved managerial quality of such CEOs. Huson et al. (2001) document that

outside appointments are associated with a more positive stock market reaction, possibly due to outside CEOs' willingness to take actions that may result in higher cash flows; however, such willingness may also increase cash flow volatility. Specifically, increased risk taking by CEOs increases cash flows but increases the volatility of cash flows in the short run, eventually leading to stable cash flows and better stock performance. In between short and long tenure, CEOs are caught in the middle, just as they are for innovation (P8a). Thus, whereas Wang et al. (2017) find that stock returns have a linear relationship to CEO tenure, we expect a U-shaped direct relationship, with CEOs with both short and long tenure obtaining higher stock returns than CEOs with a medium tenure. Thus:

P8b: CEO tenure has a U-shaped direct relationship to stock returns.

Functional expertise Management researchers have widely discussed the influence of an executive's career path on his or her decision making (e.g., Barker and Mueller 2002; Brower and Nath 2018). For example, Dearborn and Simon (1958) argue that experience with the goals, rewards, and methods of a functional area leads managers to perceive and interpret information in ways that suit and reinforce their functional training.

TMT functional diversity has a positive effect on a firm's innovation orientation and outcome (Barker and Mueller 2002; Talke et al. 2011). Prior research examining the relationship between CEOs' functional background and performance shows that those with experience in "output" functions, including marketing, R&D, product design, and sales, put greater emphasis on growth-oriented actions such as those involving new opportunities, because they better appreciate the value of such actions (Hambrick 2007). Compared with CEOs with "throughput" experience (e.g., accounting, finance, production, administration, legal), CEOs with output

experience are better able to envision how to exploit related innovation resources to gain competitive advantage in product markets (Saboo et al. 2017). In marketing, Boyd and Kannan (2018) find that the percentage of a CEO's functional expertise in marketing influences stock returns from third parties for product excellence. Brower and Nath (2018) show that appointing a CEO with a marketing background is directly associated with increasing market orientation in the firm. Whitler et al. (2018) find that marketing-experienced board members positively affect firm-level revenue growth. By contrast, CEOs with experience in throughput functions put greater emphasis on cost-reduction strategies to yield efficiency gains (Hambrick and Mason 1984) than on growth through innovations. Therefore, *ceteris paribus*, we propose the following:

P9: CEO output functional expertise is positively related to innovation.

Marketing scholars have largely focused on the influence of CMOs on firm performance (e.g., Feng et al. 2015). Boyd et al. (2010) find that when the CMO has greater role-specific experience, the negative effect of customer power on firms' market value is lower. Wang et al. (2015) document a U-shaped relationship between CMO experience and abnormal returns. Focusing on CEOs' experience, Saboo et al. (2017) find that their output experience (related to marketing, sales, and R&D functions) in acquisition contexts moderates the stock return impact for the firm. Considering that the only study to address the relationship between CEO output experience and stock returns focuses on its moderating role, we do not propose a main effect hypothesis here.

There is a gap in the literature across the three domains of finance, management, and marketing on the important question whether CEOs' functional expertise, associated with innovation output, is positively related to stock returns. Warren et al. (2019) try to fill this gap in

the literature by linking CEO marketing (vs. other functional) expertise to both innovations and patents and, more important, by assessing the subsequent stock market impact on appointments of CEOs with marketing expertise and subsequent firm innovation output.

CEO compensation

Compensation is directly under a firm's control and thus is critical in directing CEO behavior, according to findings from agency theory literature. Indeed, among the four categories of variables discussed, compensation is most closely connected with firm cash flows and residual values, as future compensation is often tied to these metrics.

Several studies have noted the positive relationship between long-term incentive-based compensation and various facets of firm innovation. For example, Bulan and Sanyal (2011) show that the granting of stocks and stock options to executives is associated with higher levels of patenting activity, which can increase cash flows and improve the residual value of the firm (Hall et al. 2007). Lerner and Wulf (2007) advance this idea by demonstrating that not only are more long-term incentives related to higher patenting activity, but the patents generated are also cited more heavily and are more original, with positive impacts on cash flows and firm residual value (Pauwels et al. 2004). Most of these studies are based on the theory that innovation is a risky activity with a long gestation period and therefore needs an incentive structure that rewards decision making on a similar time frame. Furthermore, the rewards from patenting and innovation often accrue over time, and therefore a CEO with a longer outlook is more likely to invest in these activities. Table 4 provides an overview of research findings linking CEO compensation to innovation and stock returns.

--- Insert Table 4 about here ---

P10a: CEO long-term incentive-based compensation is positively related to innovation.

Beyond innovation, several studies link CEO compensation to various firm performance metrics, primarily through the increase and acceleration of cash flows. Sigler and Carolina (2011) find an overall positive relationship between CEO total compensation and firm performance, as measured by ROE. Earlier studies have consistently demonstrated that the type of compensation CEOs receive is more indicative of firm performance than the total amount of compensation. For example, Mehran (1995) finds that the proportion of equity compensation, and not total compensation, is what drives firm value. The key dependent variables used in this study are Tobin's q and ROE, highlighting the role of compensation in enhancing residual value and increasing and accelerating cash flows. Finally, Chang et al. (2010) use a unique technique to tease out the impact of CEOs and their compensation on firm performance—CEO departure. They find that stock returns are negatively related to the firm's prior performance and CEO pay when that CEO departs. They therefore claim that the hypothesis that purely non-CEO-related factors drive changes in firm performance can be rejected.

Accounting for the simultaneity between firm value and CEO compensation, Lilling (2006) finds a robust relationship to changes in the firm's market value. Examining the 1936–2005 period, Frydman and Saks (2010) find a weak relationship between CEO compensation and stock returns. They propose that the stronger relationship in the last 30 years derives from the strong alignment of TMT compensation with shareholder incentives over time.

Research has also investigated other contingent factors that may affect the compensation–performance relationship. Luo et al. (2012) find that increasing the ratio of CEO compensation derived from long-term elements is associated with an increase in customer satisfaction, which in

turn leads to positive stock returns. Relatedly, O'Sullivan and McCallig (2012) demonstrate that increased earnings moderate the customer satisfaction–firm value relationship. Morse et al. (2011) find that powerful CEOs often rig their own compensation, and a one standard deviation increase in pay due to rigging is associated with a subsequent reduction in stock returns of 4.8%. Disparity of pay among TMT members has a detrimental effect on returns, especially in high-tech industries (Siegel and Hambrick 2005), a finding confirmed by Bebchuk et al. (2011). This effect is more pronounced when the TMT group is comparable in terms of skills, experience, and other comparable dimensions, which stimulates social comparisons (Fredrickson et al. 2010). Relatedly, Carpenter and Sanders (2002) show that CEO pay is related to TMT pay, which in turn is related to firm performance.

Bansal et al. (2016) provide boundary conditions for the effect of equity compensation, by demonstrating that deviation from market-based compensation negatively affects various metrics of firm performance, including ROA and annual stock returns. The literature thus lends strong support to the idea that equity-based, long-term compensation schemes, for both CEOs and CMOs, work to improve stock returns. Thus:

P10b: CEO long-term incentive-based compensation has a direct positive relationship to stock returns.

Thus far, research in this area has not provided much insight into the path connecting compensation with stock returns through its impact on innovation. An exception is Cheng and Farber (2008), who find that a reduction in the amount of variable (option-based) compensation offered to CEOs leads them to make fewer very risky decisions (e.g., radical innovations), in turn leading to increases in stock returns, probably through a reduction in cash flow volatility. This study therefore hints at an inverse relationship to that proposed previously—long-term incentives

are associated with more risky innovations and lower stock returns. However, the lack of other corroborating studies prevents us from generalizing this finding into a proposition.

Overall, we observe an abundance of research on CEO characteristics and their impact on firm performance, but several inconclusive results remain. By contrast, research on CMOs suffers from a scarcity of studies on their characteristics, their effects on innovation, and firm performance. Next, we review the limited extant findings on CMOs and then offer directions for future research on (1) CEOs, highlighting the need to resolve some conflicting findings and to provide a meta-analysis, and (2) CMOs, calling for studies that build a knowledge base similar to that on CEOs.

CMO characteristics and innovation/stock returns

Our study of this literature also revealed that, compared with CEOs, research on CMOs and their impact on firm performance is relatively limited. Nascent literature in marketing has focused on the presence of a CMO in a firm and its relationship to firm performance (see, e.g., Table 1 in Nath and Mahajan 2017; Wiedeck and Engelen 2018). While early evidence is mixed, recent research finds that CMO presence improves firm performance (e.g., Germann et al. 2015; Nath and Bharadwaj 2020). In terms of CMO characteristics, Table 5 summarizes the early research similar to that for the CEO variables discussed previously.

--- Insert Table 5 about here ---

With respect to demographics, Wang et al. (2015) find that CMOs with MBA degrees increase abnormal stock returns. They argue that management education enhances the CMO's ability to build and integrate organizational resources and competencies that increase cash flows and, thus, firm performance. Likewise, Homburg et al. (2014) find that CMOs with an MBA

educational background conform to investors' cognitive expectations of marketing capabilities, which results in a higher likelihood of venture capital funding.

Research has also investigated the impact of CMO experience and tenure. The accumulated CMO knowledge of informational tasks gives investors "the comfort of knowing the firm is being led by those who have done it before" (Cohen and Dean 2005, p. 686). Wang et al. (2017) find that as CMO tenure increases, the positive relationship of information reach with stock returns grows stronger, implicitly indicating lower cash volatility. In a similar vein, Boyd et al. (2010) find that when the CMO has greater role-specific experience, the negative effect of customer power on the firm's market value is lower. Examining nonlinear effects, Wang et al. (2015) document a U-shaped relationship between CMO tenure and abnormal returns, arguing that past marketing experience endows CMOs with tacit knowledge and strategic insights that enable them to enrich the organization with fresh perspectives early in their tenure, resulting in improved cash flows and higher firm residual value.

Research has paid little attention to how CMO personality and incentives affect stock returns or innovation activities. Two notable exceptions are Kim et al. (2016), who demonstrate that CMO equity compensation has an impact on firm value over and above that of other TMT members and that the CMO's strategic discretion moderates this relationship, and Fabrizi (2014), who ties CMO equity incentives to Tobin's q .

In summary, research on CMO personality, demographics, experience, and compensation is sparse, especially when compared with the wealth of knowledge on these factors for CEOs. We use the gaps in the literature to motivate an agenda for future research.

Future Research Agenda

Future research on CEO characteristics and innovation/stock returns

As we discussed, research on CEO factors and their impact on various measures of firm outcomes abounds (for a summary of propositions, see Table 6). Despite this, further research is required in the area to resolve the conflicting findings. In the following subsections, we document the most promising avenues, based on our review of extant literature.

Future research on CEO personality We note three main areas for future research on CEO personality. First, mixed findings have emerged for several personality characteristics, revealing a need for investigating the conditions under which the effect is negative versus positive. Srivastava et al.'s (1998) framework is helpful in this regard, as researchers may propose and find different effects of CEO personality on, for example, cash flow acceleration, size, and volatility. Second, we document an indirect positive effect of overconfidence (P1b) and a direct negative effect of overconfidence on stock returns (P1c), and the net impact of these could result in an intuitively appealing inverted U-shaped relationship, which needs to be investigated. Third, the interactions among the personality characteristics arouse rich conceptual and empirical puzzles. For example, what happens when a CEO with a military background is overconfident?

Future research on CEO demographics We provide several future research directions for CEO demographics. First, the conflicting findings regarding the relationship between gender and innovation/stock returns suggest that there are key unmeasured mediators or moderators that explain the differences. For example, how does product category (e.g., product vs. service) or consumer segment (e.g., gender, consumption habits) affect the CEO gender–stock returns relationship? Second, CEOs' social media profiles and activities (e.g., Tweets) are important components of their personal brand, and thus their financial impact cannot be ignored. Future research could explore whether the CEOs' digital activities interact with their demographics to

influence cash flows and firm performance. Third, as discussed previously, we expect CEO sensation seeking is positively associated with innovation. Also, as noted, research in psychology/economics shows that women are more risk averse than men (Bernasek and Shwiff 2001; Byrnes et al. 1999). Thus, for example, is the effect of sensation seeking on innovation greater for female CEOs than their male counterparts?

Future research on CEO experience Again, a gap exists in the literature on whether CEO marketing functional expertise is associated with innovation and stock returns. Warren et al. (2019) link CEO marketing versus other functional expertise (e.g., finance) to innovation and assess the subsequent stock market impact on such CEO appointments and their subsequent innovation output, representing an important step in addressing this research gap. A key contribution of that study is that it disentangles the effects of the announcement of patents filed by the firm and its innovation output.

Also pertaining to CEO experience, the variables of CEO networks and CEO duality (e.g., in which the CEO is also on the board of directors) and their relationships to innovation and stock returns need to be investigated. Networks offer personal connections that increase a CEO's access to relevant information on current market opportunities, which helps increase cash flows and firm performance, making this an important variable. Regarding duality, Adams et al. (2005) find that firm performance becomes more variable as decision-making power becomes more centralized in the hands of the CEO with role duality. Hauser (2018) shows that a reduction in board appointments (generated by mergers) is associated with increased cash flows from higher operating profits and higher stock returns. While the former article concludes that firms with powerful CEOs (with dual roles) are not only those with the worst performance but also

those with the best performance, the latter provides evidence that role duality is detrimental to firm performance. Further research is clearly necessary to resolve these differences.

Future research on CEO compensation The findings from CEO compensation research are more consistent than those from the other areas (specifically, the positive impact of long-term compensation). Yet several avenues for future research abound. For example, scholars need to pay more attention to the various types of long-term compensation and the differential impact thereof, as these factors relate to both cash flows and residual firm value. Relatedly, researchers need to better understand the boundary conditions for long-term compensation. Specifically, under what conditions (perhaps related to personality or demographics) does such compensation work better in driving cash flows and firm stock performance?

Finally, a great deal of negative attention has been paid to CEO compensation in recent years. It would be fruitful to investigate (1) the impact of such coverage on the compensation mix itself and (2) whether such negative coverage changes CEO behavior enough to have an impact on innovation and stock returns.

--- Insert Table 6 about here ---

Furthermore, we previously argued that CEO characteristics can be linked to stock returns directly (i.e., without an effect on innovations by relying on investors' cash flow expectations), particularly the prospect of increasing and accelerating future cash flows, reducing associated risks, and increasing residual value (Srivastava et al. 1998). We call for research that empirically examines how CEO characteristics influence each of the four mechanisms to further illuminate the direct stock return impact.

In addition, future research could explore more generally how patent announcements and subsequent innovation differently affect stock returns, as not all patents lead to product commercialization. From an overall perspective, we also call for research to investigate whether and how industry factors (e.g., concentration, volatility, technology) moderate the four CEO characteristics studied and whether they aid in resolving conflicting findings in current studies. For example, younger CEOs may help increase stock returns more in high-tech industries, while older CEOs may do so more in low-tech industries. Thus, despite the vast literature on CEO characteristics and their impact, several opportunities exist to contribute in this area, as outlined here. By contrast, the literature on CMO characteristics is limited, and therefore we propose a fresh agenda for future research based on what we learned from our review of existing CEO literature.

Future Research on CMO characteristics and innovation/stock returns

Future research on CMO personality While we expect many of the findings on CEO personality to hold up for CMOs, a key challenge to future research is the efficient measurement of such characteristics across many firms. For example, it may not be feasible to collect CMO personal financial decisions—specifically, whether they exercise fully vested stock options—as a proxy for overconfidence, as Malmendier and Tate (2005) do for CEOs. We propose using natural language processing of publicly available information of CMOs’ statements (see Winkler et al. 2020 for a recent application). Recent research has applied Linguistics Inquiry and Word Count to the 2016 U.S. presidential debates (Bond et al. 2017; Jordan and Pennebaker 2017). Cognitive and emotional processes, such as overconfidence and sensation seeking, appear especially suitable for such analysis, which in our opinion may yield more accurate metrics than the accounting proxies used for CEOs in previous literature.

Moreover, most of the propositions on the impact of CEO personality on innovation and stock returns are similar for CMO personality, at least insofar as the CMO has sufficient power on the board to (partly) drive innovation and other strategic decisions affecting stock returns (Webster et al. 2005). Thus, future research should pay special attention to the roles of the CMO and other board members in the firm's innovation and value-creating strategies (Verhoef and Leeflang 2009; Webster et al. 2005).

For a few characteristics, our CMO impact expectations differ from our CEO propositions, given the marketing background of CMOs (Pauwels 2014). For example, training small firm managers in marketing versus finance may result in a growth focus instead of an efficiency focus (Anderson et al. 2018). Therefore, we would expect CMOs to be more sensation seeking than executives with a financial background. Starting from such a high baseline, the relationship between CMO sensation seeking and stock returns may show diminishing returns and even an inverted U shape by itself. Moreover, a match between CMO and CEO characteristics is likely to improve innovation output and stock returns, while a mismatch (e.g., a sensation-seeking CMO and a conservative CEO) is likely to suppress firm performance.

Future research on CMO demographics Among the demographic factors in our framework, extant CMO research has mainly focused on the link between education and firm performance. As such, topics on other demographics could be explored further. For example, while the review of the CEO gender–innovation/stock returns relationship shows substantial controversies, our expectation for female CMOs is more unanimous given the fit between women's unique traits and CMO responsibilities. Research shows that, in general, female leaders have better communication skills, a more cooperative leadership style, and better understanding of consumer behavior and customers' needs than their male counterparts (Brennan and McCafferty 1997;

Wood et al. 1985). This is consistent with the key responsibilities of the CMO to represent and communicate a company's objectives and values both internally and externally. Regarding more recent growth drivers, such as digital transformation, *Forbes* reports that more than half the world's top-50 most influential CMOs, who are the best at driving transformational change within and outside their organizations, were female (Rooney 2018). Future research could investigate whether and how female CMOs may increase cash flows and reduce cash flow volatility, thus increasing stock returns. Moreover, how do firm- and industry-specific contextual variables (e.g., firm size, firm age, technology intensity, industry life cycle, industry competition) moderate these relationships?

Furthermore, the *synergies* of CEO and CMO are important topics that lack research efforts. The right CEO–CMO team can be one of the most powerful forces for positive change and growth of a company (Maycotte 2016). Prior research has shown that CEOs prefer to work with demographically (e.g., gender, age, educational background) similar individuals, who are more likely to support their leadership and decision making (Kaczmarek et al. 2012; Ke et al. 2019; Westphal and Zajac 1995). However, executives from different backgrounds may bring different perspectives into decision making, potentially improving firm performance (Finkelstein et al. 2009; Hambrick and Mason 1984). Future research could provide insights on the optimal CEO–CMO pairings in terms of demographic characteristics that drive the most innovation and stock returns.

Future research on CMO experience Our review indicates that most studies have focused on the presence of the CMO and its impact on firm stock performance, leaving open a range of potential questions for future research. Academics and practitioners have long lamented that marketing is losing its seat at the table, with low average CMO tenure (~23 months) often being

offered as evidence. We expect that newly appointed CMOs (i.e., those with low tenure) will focus on functions such as marketing communications and pricing because they do not yet have the political capital to start big innovation projects. Over time, CMOs may gain such capital and be able to choose more products from the firm's NPD pipeline that have the potential to succeed. Longer tenure of the CMO fosters tacit knowledge, which is conducive to innovation (Homburg et al. 2014; Lam 2000) and indicative of a linear relationship between CMO tenure and innovation. As tenure increases, the CMO should gain a better appreciation of the risk–return tradeoff in the firm, leading to stronger investor returns. In addition, CMO tenure should positively affect the marketing capabilities of an organization; additional research is necessary on the interplay between the firm's marketing capabilities and CMO tenure and their effects on innovations and stock returns.

Regarding functional expertise, we expect that all CMOs have functional expertise in marketing, but its extent varies among them. They should be able to adapt to external environments by leveraging diverse market- and customer-related information sources and championing product innovations (Chaganti and Sambharya 1987). Future research could investigate the effect of CMOs' differential functional expertise in value creation (e.g., innovations, new product development), value communication (e.g., marketing communications), and value capture activities (e.g., pricing, customer relationship management) on innovation and stock return (Homburg et al. 2015). For example, CEOs with brand management expertise may be uniquely qualified to build differentiated brands that can increase the equity of the brands owned by the firm and, thus, the firm's residual value (Srivastava et al. 2008).

Future research on CMO compensation CMOs drive critical value creation (R&D) and value appropriation (advertising) decisions, so their compensation design is likely to have an impact on cash flows and firm residual value. As noted, marketing literature has paid scant attention to these issues thus far. Given that compensation details are available with relative ease, researchers could compare how the various elements of pay structure for CMOs affect firm innovation and stock returns and how these relationships compare with CEOs. CMOs may have a greater impact on firm innovation because they are closer to innovation-related decision making than CEOs, while the impact on stock returns may be weaker, as their impact may be mediated via CEO decisions. The former relationship may demonstrate decreasing returns if CMOs have limited control over innovation even when motivated by the right compensation schemes. Along these lines, what is the impact of CMO pay structure, CEO tenure, and the types and riskiness of innovation undertaken (incremental vs. radical)? We anticipate a relationship in which the level of risk taking is related to the amount of variable, long-term compensation CMOs receive. With CEO tenure, we may find a nonlinear interaction effect with compensation, in line with the main effect of tenure on innovation.

It is clear that CMO compensation interacts with personal and demographic characteristics to affect innovation and stock returns. We expect, for example, that education and gender will interact with compensation elements to modify CMO risk appetites and thereby relate to both innovation and stock returns. Similarly, intrinsic characteristics such as overconfidence or sensation seeking may interact with compensation. Finally, the interaction between compensation and experience could affect innovation and stock returns, perhaps even nonlinearly. As tenure has a U-shaped relationship to innovation, the interaction with compensation may also produce a U-shaped response.

Managerial Implications

Our research suggests several implications for practice. First, our findings offer implications for boards of directors and CEOs. To begin with, board members responsible for the selection of CEOs need to recognize that personality, demographics, and experience are key factors in driving critical firm performance metrics such as innovation and stock returns. Boards of directors need to be cognizant that characteristics such as overconfidence, military background, political ideology, and gender may affect not just decision making but also innovation output and shareholder returns. As a recent *Wall Street Journal* article (Stoll 2019), quoting David Larcker states, “Boards have to consider whether the same thing that made that person a successful CEO, for instance, also led them to engage in highly risky hobbies.”

Second, TMT compensation in terms of *how much* executives are paid has been a relentless focus of the press and the public. We argue that *how* they are paid is far more important in driving innovations and shareholder value. For boards of directors, this review therefore offers insights into how to create incentives (e.g., by offering long-term, incentive-based compensation) that make it in the TMT’s best interests to do what is in shareholders’ best interests. An interesting twist in this regard would be the differential use of compensation for different TMT members. For example, in situations in which firms want to play a defensive strategy, CMOs may be compensated with higher fixed pay to *reduce* risk taking through innovation, while CEOs are compensated to increase stock returns through greater long-term pay.

Finally, investors and analysts need to pay attention to TMT characteristics to help them understand future cash flows and firm performance. To the extent that they correctly anticipate these characteristics’ impact on firm value (a key question for future research), they can

incorporate their effects in the future value of the firm, in which case abnormal stock returns would only occur in the face of new information (e.g., the announcement of a new TMT member or the public discovery of a previously unknown characteristic of an existing TMT member). The factors discussed previously may provide investors with information about innovation, cash flows, and even stock performance, over and above what may be available through the usual channels.

Conclusion

In this article, we comprehensively review the substantial and diverse body of research on how CEO/CMO characteristics (i.e., personality, demographics, experience, and compensation) affect innovation and stock returns for firms to propose “what we know” about the relationship and to provide future research directions on “what we need to know” for CEOs and CMOs. Bridging multiple streams, future research could substantively enrich the marketing literature, and we hope our study inspires more work on this topic in marketing.

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Fig. 1 Number of articles by journal and field

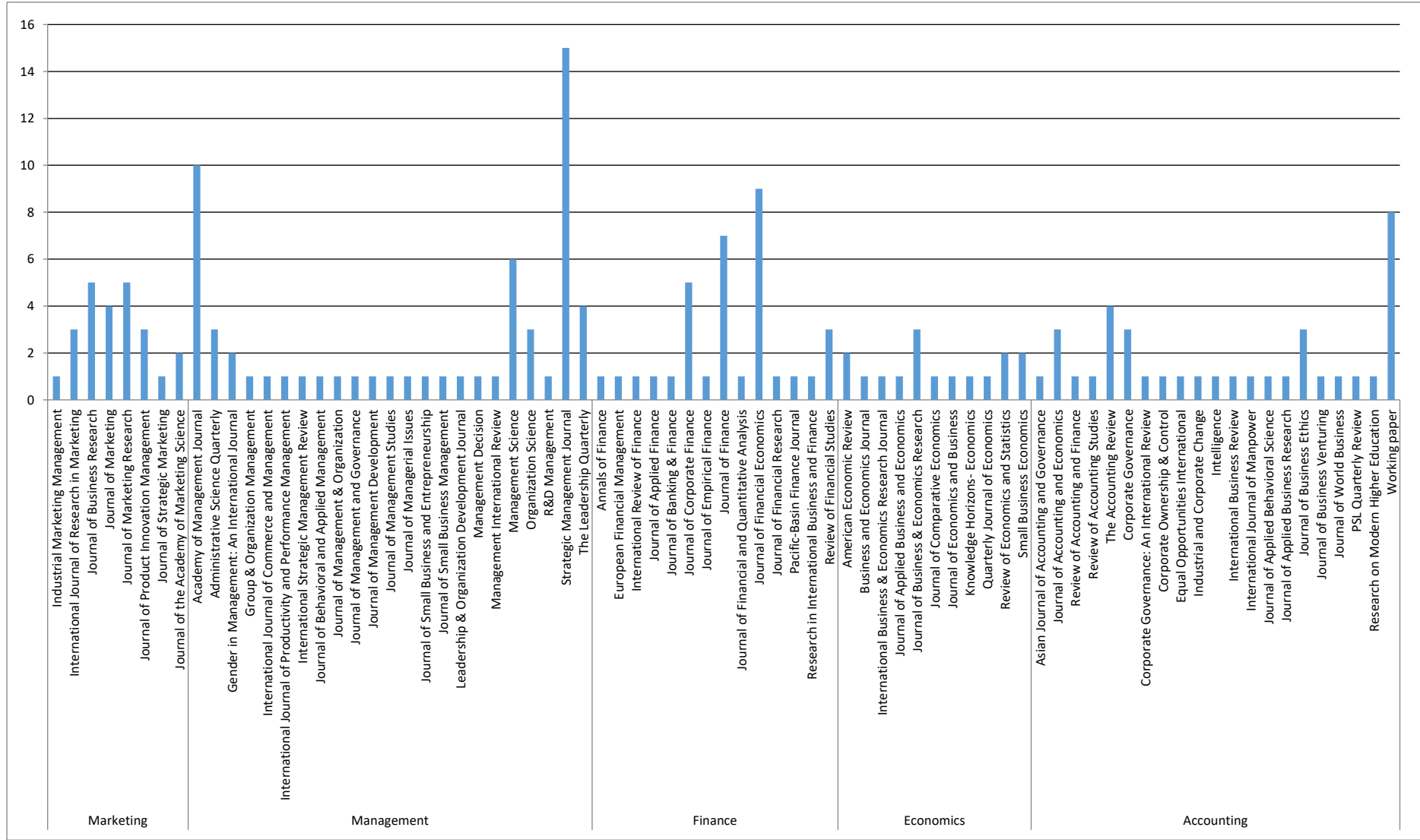


Fig. 2 Conceptual framework: CEO characteristics and stock returns

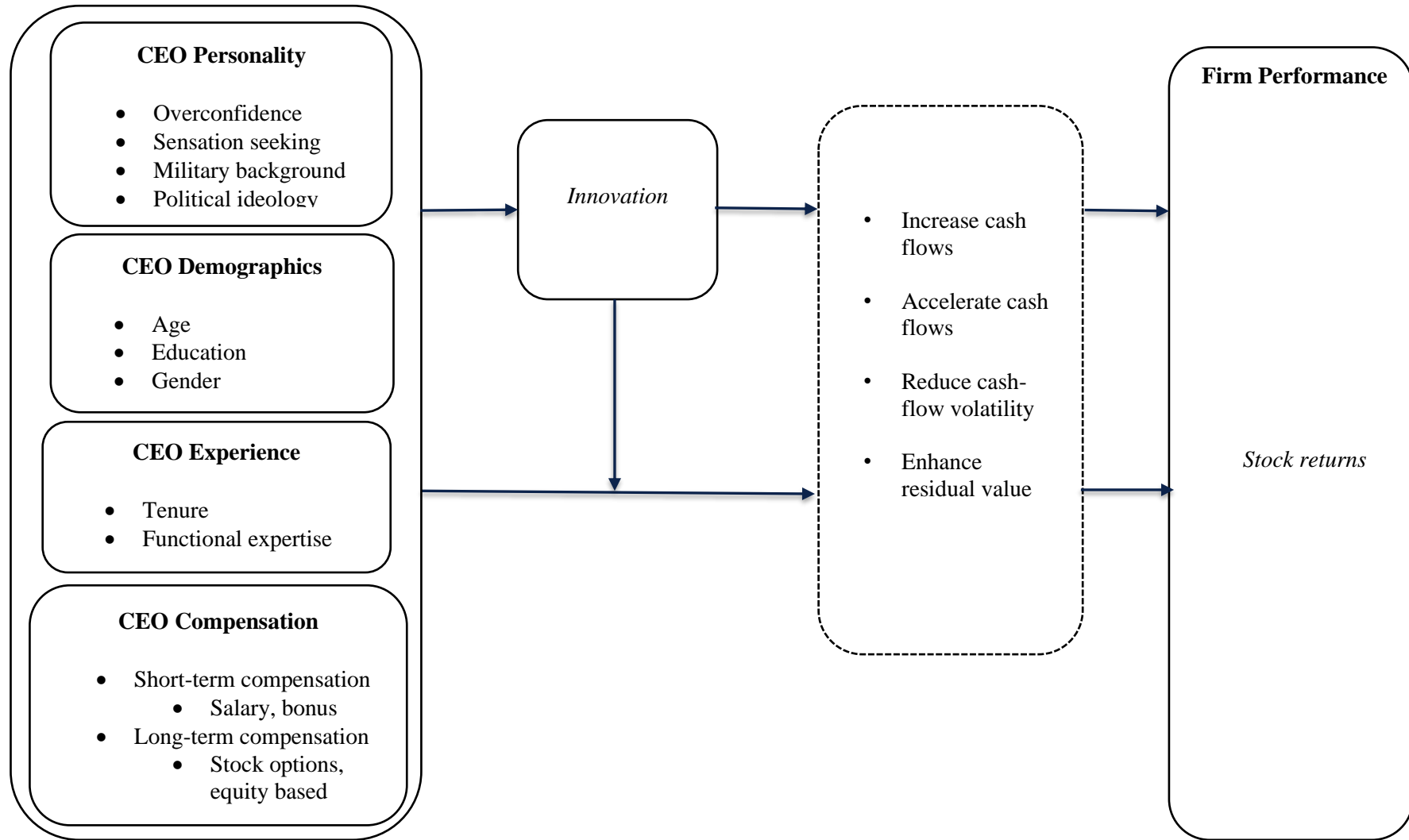


Table 1 CEO personality and stock returns: Overview of findings

Characteristic	Illustrative article*	Explanatory variable operationalization	Focal variable operationalization	Findings
Overconfidence	Malmendier and Tate (2005)	Holder67 = 1 for CEO who fails to exercise an executive option after stock price has risen by at least 67%.	Investment = firm capital expenditures normalized by the capital at beginning of the year	Overconfident managers overestimate the returns to their investment projects and view external funds as unduly costly. Thus, they overinvest when they have abundant internal funds but curtail investment when they require external financing
Overconfidence	Galasso and Simcoe (2011)	Holder67 indicator	Citation-weighted patent counts	Overconfident CEOs, who underestimate the probability of failure, are more likely to pursue innovation, and this effect is greater in more competitive industries.
Overconfidence	Hirshleifer et al. (2012)	Holder67 and a fixed effect “maximum holder67”	Standard deviation of stock returns; innovation = R&D expenditures and patenting activities	Overconfident CEOs have greater return volatility, invest more in innovation, obtain more patents & citations, and have innovative success for given R&D expenditures. However, they do so only in innovative industries.
Sensation seeking	Sunder et al. (2017)	Pilot license	Patents and cumulative abnormal returns at their announcement, R&D productivity	Patents by pilot CEOs create more shareholder value; those by military CEOs create less. Pilot CEOs enhance innovation performance by improving R&D productivity.
Military background	Benmelech and Frydman (2015)	Military service listed in “Who’s Who in Commerce”	Tobin’s q, R&D investment, corporate investment, fraud	Military CEOs pursue lower corporate investment, invest less in R&D, are less likely to be involved in corporate fraudulent activity.
Military background	Lin et al. (2018)	Hand collected from the executives’ resumes	R&D investments Return on sales	Military CEOs perform more poorly than others, except in downturns, and they are more likely to be involved in fraud.
Political ideology	Kashmiri and Mahajan (2017)	Political contributions by CEO to Democratic and/or Republican party	New product introductions, Tobin’s q, stock market volatility	Firms led by Democratic-leaning CEOs have more NPIs and higher Tobin’s q but also stock return volatility. Effects are weaker when CEOs have low power, when the marketing department has high influence, and when the economy is growing.
Political ideology	Unsal et al. (2016)	Financial contributions to both Democratic and Republican parties during elections	Tobin’s q, agency cost of free cash flow, excess return over time	Compared with Democratic and Apolitical rivals, Republican managers generate higher agency costs of free cash flow, lower Tobin’s q, and smaller increases in buy and hold abnormal returns.

Table 2 CEO demographics and stock returns: Overview of findings

Characteristic	Illustrative article	Explanatory variable operationalization	Focal variable operationalization	Findings
Age & Education	Barker and Mueller (2002)	Age in years No college, undergraduate, master's, doctorate; Number of business/economics (or science/engineering) degrees	Total R&D dollars	R&D spending is greater for firms with younger CEOs. CEO education level has no significant association with R&D spending after a CEO has attained a college degree. Number of science/engineering degrees is positively associated with R&D spending; number of business degrees has no association with higher R&D spending.
Age & Education	Bertrand and Schoar (2003)	Age in years MBA degree vs. not	ROA and Tobin's q; R&D investment	Older executives choose less aggressive strategies. CEOs with MBA degree are associated with ROA levels on the order of 1% higher than for non-MBA graduates and choose more aggressive corporate strategies.
Age	Serfling (2014)	Age in years	R&D intensity; Abnormal stock returns	Older CEOs invest less in R&D. Firms managed by older CEOs underperform firms led by younger CEOs.
Age, Education & Gender	Zhang and Sun (2017)	Age in years Special, college, undergraduate, master, doctorate Proportion of women in TMT	R&D investment; R&D intensity	TMT executive's age (education level) is negatively (positively) associated with R&D investment. No significant positive relationship between percentage of women in TMT and R&D investment.
Age	Morresi (2017)	Age in years	ROA; ROE; market-to-book ratio; stock returns	Firms led by younger CEOs at the time of their appointment perform better than others.
Age & Education	Cheng et al. (2010)	Age in years 4-year university degree or above vs. not	ROA; EPS; Cumulative stock returns; Cumulative abnormal returns	Older CEOs are more likely to generate higher ROA, cumulative stock returns, and cumulative abnormal returns. Firms perform better when they are managed by CEOs who possess a university degree or above.
Age, Education & Gender	Nguyen et al. (2015)	Age in years MBA degree vs. not; Ivy League vs. not Female CEO vs. not	Cumulative abnormal returns	CEO's age is positively and significantly related to firm's stock market returns. CEO's Ivy League education is significantly and positively related to firm's stock market returns. CEO's MBA degree is not related to firm's stock market returns. No significant relationship between CEO gender and stock market returns.
Education	Camelo et al. (2010)	Non-university studies, diploma holder/technical engineer, graduate/ engineer, doctor/master	Number of new products; Number of improved products	A higher education level in the TMT has a positive effect on the firm's innovation performance.
Education	Lin et al. (2011)	College or above vs. not	R&D intensity	CEO education level is positively associated with firm's R&D investment.

Education	King et al. (2016)	Undergraduate, MBA, doctorate; top-20 school vs. not	Bank's ROA less mean ROA of all other banks	CEOs with better MBA education who follow riskier or more innovative business models achieve superior bank performance outcomes.
Education	Goll et al. (2001)	High school, some college, Bachelor's degree, Master's degree, JD, doctorate	ROA; ROE; return on sales (ROS); earnings per share (EPS)	TMT education level is positively related to firm performance.
Education	Bhagat et al. (2010)	MBA degree vs. not	ROA (short-term); Stock returns and Tobin's q (long-term)	Firms led by CEOs with an MBA degree from the top 20 business schools have greater stock returns and a higher ROA.
Gender	Dezsö and Ross (2012)	Female CEO vs. not	Tobin's q	Female executives improve firm performance but only insofar as a firm's strategy is focused on innovation.
Gender	Yao (2015)	Female CEO vs. not	R&D; Patent; Total innovation expenditure	Female CEOs can significantly promote firms' technological innovation.
Gender	Strohmeier et al. (2017)	Female leader vs. not	New or substantially improved products or services	Firms led by women exhibit less innovation breadth and depth than those led by men.
Gender	Jalbert et al. (2013)	Female CEO vs. not	ROA; ROE; ROI	Female CEOs are positively related to firm's ROA and ROI.
Gender	Khan and Vieito (2013)	Female CEO vs. not	ROA adjusted	ROA increases much more if the firm is managed by a female CEO instead of a male CEO.
Gender	Peni (2014)	Female CEO vs. not	Tobin's q and ROA	There is a positive relationship between the presence of female CEOs and firm performance.
Gender	Lee and James (2007)	Female CEO vs. not	Stock returns	Announcements of female CEO appointments generate more negative stock market reactions than announcements of male CEOs.

Table 3 CEO experience and stock returns: Overview of findings

Characteristic	Illustrative article	Explanatory variable operationalization	Focal variable operationalization	Findings
Tenure & Functional experience	Barker and Mueller (2002)	Experience in marketing/sales; R&D engineering; finance/accounting & legal	R&D expenditure: total R&D dollars spent per employee by each firm relative to its industry average.	R&D spending is greater at firms in which CEOs have longer tenure and significant career experience in marketing and/or engineering/R&D.
Tenure	Balsmeier and Buchwald (2014)	CEO tenure in office in years	Patent application Patent citation Presample patent stock	CEO tenure has a negative influence on patenting activity of 8% per year. May reflect lower incentives to foster innovations, the longer the CEO is in the office the less likely he/she is able to reap the benefits.
Tenure	Chen (2013)	CEO tenure in office in years	R&D expenditures to total sales	An inverted U-shaped relationship between CEO tenure and R&D investment, with positive moderating effects of board human and social capital.
Tenure	Simsek (2007)	CEO's number of years in office	TMT risk taking measured using 3-item, 7-point scale	CEO tenure indirectly influences performance through its direct impact on TMT risk-taking propensity and the firm's pursuit of entrepreneurial initiatives.
Tenure	Huson et al. (2001)	Annual compensation, CEO turnover	Accounting earnings and stock returns	Outside appointment is associated with positive stock market reaction and higher post turnover firm performance.
Functional experience	Saboo et al. (2017)	Dummy variable: 1 if the dominant background of the CEO is in a throughput function and 0 otherwise	Cumulative abnormal returns	Acquirer CEO's throughput background and acquisition experience negatively moderate the target's innovation resource quality and the acquirer's marketing intensity positively moderates the influence of innovation overlap.
Functional experience	Talke et al. (2011)	Functional background: finance, marketing, HR, product/operations, R&D, IT, legal/general counsel, and others. Heterogeneity: Herfindahl index.	Firm innovativeness: degree of innovativeness of the firm's new product portfolio; Tobin's q	TMT functional diversity has a strong positive effect on a firm's innovation orientation. A strong proactive focus on customer needs and novel technologies leads to a portfolio of new products with higher market and technology newness, which increase firm performance.
Functional experience	Boyd and Kannan (2018)	Percentage of a CEO's functional experience in marketing and sales	Market value: Stock price \times common shares outstanding	CEO market experience is a factor in influencing the value a firm creates from receiving third-party recognition for design excellence.
Functional experience	Whitler et al. (2018)	Number of board members with executive level marketing experience	Annual revenue growth: year-over-year percentage change in annual firm revenues	Marketing-experienced board members positively affect firm-level revenue growth, and this relationship is strengthened or weakened by important contingencies that occur in the firm.

Table 4 CEO compensation and stock returns: Overview of findings

Characteristic	Illustrative article	Explanatory variables operationalization	Focal variable operationalization	Findings
Long-term incentives	Bulan and Sanyal (2011)	Share price sensitivity; volatility sensitivity	Patent counts; cite-weighted patent counts	Positive relationship between firm patenting activity and stock and option grants.
Long-term compensation	Lerner and Wulf (2007)	Log of total comp; ratio of long-term comp to total comp	Patent citations; originality	More long-term incentives associated with more heavily cited patents, more patent awards, and more original patents.
CEO pay post-Sarbanes Oxley	Sigler and Carolina (2011)	Log of total CEO comp	ROE	Positive and significant relationship between CEO compensation and ROE.
Type of compensation	Mehran (1995)	% of total comp in grants of new stock; % of equity-based comp; % of comp in salary + bonus	Tobin's q and ROA	Performance is positively related to proportion and amount of equity-based comp, rather than total level of comp.
Changing CEO compensation mix	Cheng and Farber (2008)	Ratio of dollar value of options to total comp; number of option grants to total shares outstanding	ROA	Decrease in option-based comp reduces CEOs incentives to make excessively risky investments, leading to profit improvements.
CEO pay	Chang et al. (2010)	CEO prior pay (when CEO departure happened)	Firm value	Better prior performance, higher prior pay, and a more negative stock market reaction are associated with worse post-departure firm performance.
Long-term compensation	Frydman and Saks (2010)	Annual pay from COMPUSTAT	Firm real rate of return	The median real value of comp was flat between 1936 and 2005, revealing a weak relationship between pay and firm growth.
Long-term compensation	Luo et al. (2012)	Percentage of stock options and restricted stock grants to total comp	Market capitalization	Increases in the proportion of CEOs' equity-based comp positively influence firm value.
Compensation	Morse et al. (2011)	PowerIndex, Insider%, %Appointed	Accounting returns, stock returns, operating EPS	Rigging of incentive pay is associated with a decrease in future firm performance and value.
Total compensation	Bebchuk et al. (2011)	CEO pay slice (CPS)	Tobin's q, ROA, acquirer returns, opportunistic timing of option grants, abnormal returns	Cross-sectional differences in CPS are associated with lower Tobin's q, lower accounting profitability, less favorable market reaction to acquisition announcements, more opportunistic timing of CEO option grants, more luck-based CEO pay, less CEO turnover, and lower stock market returns.
CEO pay	Carpenter and Sanders (2002)	CEO pay and TMT pay	Firm performance, ROA, and Tobin's q	CEO pay is related to TMT pay; TMT comp, in turn, predicts performance (i.e., ROA and Tobin's q) when aligned with shareholder interests and internal contingencies. The effect of CEO pay on future firm performance is dependent on top team pay.

Table 5 CMO characteristics and stock returns: Overview of findings

Characteristic	Illustrative article	Explanatory variable operationalization	Focal variable operationalization	Findings
Demographics				
Education	Wang et al. (2015)	MBA degree	Abnormal returns	CMO's MBA degree is positively associated with firm's abnormal stock returns.
Education	Homburg et al. (2014)	MBA degree	Venture capital funding	CMO's MBA degree is positively related to the likelihood of funding.
Experience				
Tenure	Wang et al. (2017)	Length of time executives have been involved in their current firm's strategies and activities	Tobin's q	A central network position in a CMO's mobility network (information reach) is positively associated with firm performance if CMO tenure is high.
Tenure	Wang et al. (2015)	Total number of years the new CMO has worked in any position or organization before taking the new position	Abnormal returns	The relationship between CMO experience and firm's abnormal stock returns is U shaped.
Role-specific experience/firm-specific experience	Boyd et al. (2010)	Appointee has past experience as a CMO and with appointing firm	Abnormal stock returns	The abnormal stock return when a firm faces high customer power is higher if the appointed CMO has past CMO experience; returns from a CMO appointment when a firm faces high customer power are lower if the appointee has past experience working for the appointing firm.
Functional experience	Homburg et al. (2014)	Marketing experience: number of years in marketing-related jobs Industry experience: number of years the executive has worked in the respective industry	Venture capital funding	CMO marketing and industry experience are positively related to the likelihood of funding.
Compensation				
Compensation	Bansal et al. (2016)	Deviations in CMO compensation	ROA; stock returns	Deviations from CMO's predicted compensation is negatively related to firm performance.
Equity incentive	Kim et al. (2016)	CMO equity incentive	Market value	Greater equity incentives allocated to CMO are positively related to firm value.

Table 6 Summary of propositions on how CEO characteristics affect innovation and stock returns

Characteristics	Variable	Propositions
<i>Personality</i>		
Overconfidence	Innovation	P1a: CEO overconfidence is positively related to innovation.
	Stock returns	P1b: CEO overconfidence has an indirect positive relationship to stock returns through innovation.
		P1c: CEO overconfidence has a direct negative relationship to stock returns.
Sensation seeking	Innovation	P2a: CEO sensation seeking is positively related to innovation.
	Stock returns	P2b: CEO sensation seeking has an indirect positive relationship to stock returns through innovation.
Military background	Innovation	P3a: CEO military background is negatively related to innovation.
	Stock returns	P3b: CEO military background has an indirect negative relationship to stock returns through innovation.
Political ideology	Innovation	P4a: CEO liberal ideology is positively related to innovation.
	Stock returns	P4b: CEO liberal ideology has an indirect positive relationship to stock returns through innovation.
<i>Demographics</i>		
Age	Innovation	P5a: CEO age is negatively related to innovation.
	Stock returns	P5b: CEO age has a U-shaped relationship to stock returns, partially mediated by innovation.
Education	Innovation	P6a: Both CEO education level and MBA degree are positively related to innovation.
	Stock returns	P6b: Both CEO education level and MBA degree have a direct positive relationship to stock returns.
Gender	Innovation	P7a: Female CEOs are positively associated with innovation.
		P7b: Female CEOs are negatively associated with innovation.
	Stock returns	P7c: Female CEOs have a direct positive relationship to stock returns.
		P7d: Innovation strengthens the positive relationship between female CEOs and stock returns.
P7e: Female CEOs have a direct negative relationship to stock returns.		
<i>Experience</i>		
Tenure	Innovation	P8a: CEO tenure has a U-shaped relationship to innovation.
	Stock returns	P8b: CEO tenure has a U-shaped direct relationship to stock returns.
Functional expertise	Innovation	P9: CEO output functional expertise is positively related to innovation.
<i>Compensation</i>		
Long-term incentive-based compensation	Innovation	P10a: CEO long-term incentive-based compensation is positively related to innovation.
	Stock returns	P10b: CEO long-term incentive-based compensation has a direct positive relationship to stock returns.

Web Appendix 1 List of major marketing and related UT Dallas journals used as basis for search

Journal of Marketing, Journal of Marketing Research, Journal of the Academy of Marketing Science, International Journal of Research in Marketing, Marketing Science, Marketing Letters, Journal of Retailing, Journal of Business Research, Journal of Production Innovation Management, Management Science, Academy of Management Journal, Strategic Management Journal, Administrative Science Quarterly, Academy of Management Reviews, Journal of International Business Studies, The Accounting Review, Journal of Accounting and Economics, Journal of Accounting Research, Journal of Financial Economics, Journal of Finance, Review of Financial Studies, and Quantitative Marketing and Economics

Web Appendix 2 CEO characteristics and firm performance: Overview of findings

Characteristic	Articles	Journal	Explanatory variable operationalization	Focal variable operationalization	Findings
Personality					
Overconfidence	Doukas and Petmezas (2007)	<i>European Financial Management</i> , 13 (3), 531–577	If managers conduct five or more acquisitions within a 3-year period vs. not	Cumulative abnormal returns	Overconfident bidders generate lower announcement returns than rational bidders and exhibit poor long-term performance.
Overconfidence	Hsu et al. (2017)	<i>The Accounting Review</i> , 92 (6), 77-101	If CEO postpones the exercise of vested options that are at least 67% in the money vs. not	Averaged value of operating cash flows scaled by assets for the future two years	Firms that practice conservative accounting and are run by overconfident CEOs exhibit better cash flow performance.
Overconfidence	Li and Tang (2010)	<i>Academy of Management Journal</i> , 53 (1), 45-68	Measured by the z-score for a subjective evaluation minus the z-score for ROS	Firm’s decision to invest in a new, high-technology project	The positive relationship between CEO overconfidence and firm risk taking was found to be stronger when CEO managerial discretion was stronger.
Overconfidence	Simon and Houghton (2003)	<i>Academy of Management Journal</i> , 46 (2), 139-149	Gap between certainty about the innovation success from interviews and the actual success	Pioneering product introductions	Overconfidence increases pioneering new product introduction for high technology firms. Pioneering product introducers more apt to express extreme certainty in success but these products were less likely to achieve success.
Overconfidence	Stock et al. (2019)	<i>Journal of Product Innovation Management</i> , 36 (1), 41-65	Deviation of top executives’ self-assessed performance from their actual performance	Product program newness	Overconfidence has a negative impact on top executives’ innovative behavior and thus product program newness.

Narcissism	Chatterjee and Hambrick (2007)	<i>Administrative Science Quarterly</i> , 52 (3), 351-386	5-item narcissism index: (1) the prominence of the CEO's photograph in the company's annual report; (2) the CEO's prominence in the company's press releases; (3) the CEO's use of first-person singular pronouns in interviews; (4) the CEO's cash compensation divided by that of the second-highest paid executive in the firm; and (5) the CEO's non-cash compensation divided by that of the second-highest-paid executive in the firm	4 indicators for strategic dynamism: (1) advertising intensity (advertising/sales), (2) research and development intensity (R&D/sales), (3) selling, general, and administrative (SGA) expenses/sales, and (4) financial leverage (debt/equity); Total shareholder returns (TSR); ROA	Narcissism in CEOs is positively related to strategic dynamism and grandiosity, as well as the number and size of acquisitions, and it engenders extreme and fluctuating organizational performance.
Narcissism	Kashmiri et al. (2017)	<i>Journal of the Academy of Marketing Science</i> , 45(5), 633-656	Average of four indicators: (1) The prominence of the CEO's photograph in the company's annual report was measured using a 4-point scale (4 = CEO alone and larger than half a page, 3 = CEO alone and less than half a page, 2 = CEO with one or more executives, 1 if no photograph). (2) CEO prominence in the company's press releases was measured as the number of times the CEO	New product introductions; Proportion of radical innovations	Firms with narcissistic CEOs tend to have higher new product introductions (NPIs) and higher radical innovation proportion.

			was mentioned in the firm's press releases divided by the total number of words in these press releases. (3) CEO's relative cash compensation was measured as the total of the CEO's salary and bonus divided by that of the second highest paid executive. (4) CEO's relative non-cash compensation was measured as the total of the CEO's monetary value of deferred income, stock grants, and stock options divided by that of the next highest paid executive. Standardized these four measures and used the simple mean of the standardized measures as overall measure of CEO narcissism.		
Narcissism	Zhang et al. (2017)	<i>The Leadership Quarterly</i> , 28, 585-604	14 items from NPI-16	Four items from the adhocracy dimension of the Organizational Culture Assessment Instrument (OCAI) for firm's innovation	Narcissistic CEOs are more likely to cultivate an innovative culture and to deliver innovative performance.
Optimism, risk, & loss aversion	Graham et al. (2013)	<i>Journal of Financial</i>	Psychometric surveys	Sales Growth	Risk-tolerant CEOs are more likely to work at high-growth firms.

		<i>Economics</i> , 109 (1), 103-121			
Facial traits	Graham et al. (2016)	<i>Management Science</i> , 63 (9), 2773-3145	Responder rating of facial traits on maturity, competence, beauty, likeability and trustworthiness	ROA	None of the facial traits effects on ROA are statistically significant and the point estimates are near zero. CEOs are generally viewed as being more mature-faced as opposed to baby-faced than are non-CEOs, and this visual maturity is positively correlated with the perception of competence and negatively related to the perception of likeability.
Creative and operational leadership	Makri and Scandura (2010)	<i>The Leadership Quarterly</i> , 21 (1), 75-88.	Coded CEO interviews for Creative leadership and Operational leadership	Patents granted, patent citations	CEO's Creative leadership (develop social and human capital and investing in the firm's internal knowledge development) and Operational leadership (explore new paths of growth as well as exploit existing ones by redefining and extending the boundaries of the firm to new product and market domains) interact to increase number of patents granted (but not patent citations)
Strategic leadership	Elenkov et al. (2005)	<i>Strategic Management Journal</i> , 26, 665–682	Strategic leadership behavior: Multi-item scales from Multifactor Leadership Questionnaire (MLQ)	(1) New products or services (for existing markets); (2) new markets (for existing products/services); and	Strategic leadership behaviors have a strong positive relationship with executive influence on product–market innovation.

				(3) new products or services for new markets.	
Transformational leadership	Chen et al. (2014)	<i>Journal of Product Innovation Management</i> , 31, 2–17	20-item scale for transformational leadership	5-item scales for new product development performance	CEOs' transformational leadership is positively related to product innovation performance.
Transformational leadership	Jansen et al. (2009)	<i>The Leadership Quarterly</i> , 20, 5-18	Multi-item scales from Multifactor Leadership Questionnaire (MLQ) for transformational leadership	Multi-item scales for exploratory and exploitative innovation	Transformational leadership behaviors contribute significantly to adopting generative thinking and pursuing exploratory innovation.
Transformational leadership	Jung et al. (2008)	<i>The Leadership Quarterly</i> , 19, 582-594	Multi-item scales from Multifactor Leadership Questionnaire (MLQ) for transformational leadership	R&D expenditures as a percentage of sales; Revenues; number of patents;	CEO transformational leadership is positively related to organizational innovation.
Transformational leadership	Matzler et al. (2008)	<i>Journal of Small Business and Entrepreneurship</i> , 21 (2), 139–152	Multi-item scales for transformational leadership	Multi-item scales for product innovativeness, growth, and profitability	Transformational leadership has a direct positive impact on innovation, growth and profitability.
Transformational leadership	Menguc and Auh (2008)	<i>International Journal of Research in Marketing</i> , 25, 34-45	Transformational leadership as a higher-order factor consisting of four first-order constructs, namely, inspirational motivation (three items), intellectual stimulation (three items), individualized consideration (three items), and idealized influence	ROA	Transformational leadership is not significantly related to firm performance.

			(or charisma) (six items). All scales use a Likert format (1 = strongly disagree; 5 = strongly agree)		
Transformational leadership	Zhu and Bao (2017)	<i>Leadership & Organization Development Journal</i> , 38 (5), 699-718	Multi-item scales from the Multifactor Leadership Questionnaire	10 indicators to measure the performance of new firms: sales growth, revenue growth, and growth in the number of employees, net profit margin, product/service innovation, and process innovation, adoption of new technology, product/service quality, product/service variety, and customer satisfaction.	Both individual-focused transformational leadership and group-focused transformational leadership have a positive effect on the performance of new firms; the interaction between individual-focused and group-focused transformational leadership is positively related to new firm performance when the organizational structure is organic; and the interaction between individual-focused and group-focused transformational leadership is negatively related to new firm performance when the organizational structure is mechanistic.
Temporal disposition	Chen and Nadkarni (2017)	<i>Administrative Science Quarterly</i> , 58 (2), 197-232	Multi-item scales for task-related hurry, pacing style and temporal leadership	Multi-item scales for entrepreneurship, corporate venturing and strategic renewal	CEO's time urgency increases temporal leadership, which in turn increases corporate entrepreneurship. Early and steady action improve, but deadline-action style inhibits CEOs temporal leadership.
Attention focus	Yadav et al. (2007)	<i>Journal of Marketing</i> , 71 (4), 84-101.	CEO future, external and internal focus from bank's letters to shareholders	Innovation = registering online domain name and developing website for ebanking	CEO attention is a critical driver of innovation even in the banking industry.

Demographics					
Age	Afrida and Tauringana (2015)	<i>Corporate Governance</i> , 15 (5), 719-733.	Age in years	Tobin's q	CEO age is positively associated with Tobin's q.
Age	Bach and Lee (2018)	<i>Journal of Behavioral and Applied Management</i> , 18 (1), 3752	Age in years	Firm profitability and firm growth	Executive age is positively related to firm growth, but not to firm profitability.
Age	Cline and Yore (2016)	<i>Journal of Empirical Finance</i> , 35, 169-188	Age in years	Tobin's q	CEO age is significantly and negatively related to firm performance.
Age	Goll et al. (2001)	<i>Management International Review</i> , 41, 109-129	Age in years	ROA; ROE; return on sales (ROS); earnings per share (EPS)	CEO's age shows a significant positive relationship to firm performance.
Age	Lam et al. (2013)	<i>Pacific-Basin Finance Journal</i> , 21, 1136-1159	Age in years	ROA; ROE	CEO age is not significantly related to firm performance.
Age	McClelland et al. (2012)	<i>Journal of Business Research</i> , 65, 1387-1393	Age in years	ROA	Older CEOs are associated with lower future firm performance.
Age	Moscu (2013)	<i>Knowledge Horizons-Economics</i> , 5 (4), 215-219	Age in years	ROA; ROE; stock returns	CEO age is not significantly related to firm performance.
Age	Peni (2014)	<i>Journal of Management and Governance</i> , 14 (1), 37-59	Age in years	Tobin's q; ROA	CEO age has a positive impact on ROA, but it does not have any significant impact on Tobin's q
Age	Rahman et al. (2017)	<i>Asian Journal of Accounting and</i>	Age in years	ROE and firm market value	CEO age has no significant effect on firm performance.

		<i>Governance</i> , 8, 27-37			
Age	Rakhmayil and Yuce (2013)	<i>Journal of Applied Business and Economics</i> , 14 (5), 52-70	Age in years	Tobin's q	The relationship between CEO age and firm performance is U-shaped.
Age	Reina et al. (2017)	<i>Organization Science</i> , 28 (2), 228–243	Age in years	ROA	CEO age is not significantly related to firm's ROA.
Age	Wilkes (2014)	Working paper	Age in years	Cumulative abnormal returns	CEO age is not significantly related to corporate performance.
Education	Bhagat et al. (2010)	Working paper	MBA degree vs. not	ROA (short-term); Stock returns and Tobin's q (long-term)	CEOs with MBA degree lead to short-term improvement in operating performance. No significant systematic relationship between CEO education and long-term firm performance.
Education	Camelo-Ordaz et al. (2005)	<i>Journal of Management Development</i> , 24 (8), 683-705	Level of education (doctorate, graduate/ engineer, diploma holder/ technical engineer and other studies)	Number of new products; Number of improved products; Number of registered patents	TMT education level is positively related to innovation.
Education	Clark and Smith (2003)	Working paper	Level of education (number of years of post-high school education)	Number of new innovations	TMT education level is positively associated with organizational innovation.
Education	Darmadi (2013)	<i>Corporate Governance: The International Journal of Business in Society</i> , 13 (3), 288-304.	Postgraduate vs. not; Prestigious university vs. not; Financial field vs. not	ROA; Tobin's q	CEOs with a higher education level are associated with better firm performance. Firms led by CEOs holding degrees from prestigious universities perform significantly better than those without such CEOs. CEOs with finance education are

					negatively related to Tobin's q.
Education	Gottesman and Morey (2010)	<i>Journal of Applied Finance</i> , 2, 70-82	Type of education (liberal arts undergraduate degree, non-liberal arts undergraduate degree, MBA, law degree)/ Quality of education (mean SAT, GMAT, and LSAT scores required by undergraduate and graduate schools)	Tobin's q	No significant evidence that the type or selectivity of CEO education is related to firm financial performance.
Education	Jalbert et al. (2011)	<i>Journal of Applied Business Research</i> , 27 (1), 15-39	Level of education (undergraduate/graduate degree vs. not); Quality of education (university ranking)	ROA; ROE; ROI	Having earned an undergraduate degree is positive and significant in explaining ROE, but not significant in explaining ROA or ROI. Top school rankings are marginally significant in explaining ROA.
Education	Jalbert et al. (2002)	<i>International Business & Economics Research Journal</i> , 1 (1), 83-98	Level of education (undergraduate vs. not, graduate vs. not); Quality of education (university ranking)	ROA; Tobin's q	CEOs that attend one of the Big graduate schools provide higher ROA than other CEOs. CEO education level is significantly and positively related to Tobin's q.
Education	Morresi (2017)	<i>PSL Quarterly Review</i> , 70 (282), 311-353	Level of education (undergraduate degree, postgraduate degree, PhD); Quality of education (university ranking); Type of education (MBA vs. not)	ROA; ROE; Market-to-book ratio; Stock returns	CEO education level is not related to firm performance. University ranking of CEOs does not affect firm performance. CEOs with an MBA degree lead to a better firm performance.

Education	Pascal et al. (2017)	<i>Small Business Economics</i> , 49, 339-354	Type of education (minimum of 3 years of university business-related education vs. not)	ROA; ROE	CEOs with a business education perform significantly better than those with other types of educational background.
Education	Perez-Gonzalez (2006)	<i>The American Economic Review</i> , 96 (5), 1559-1588	Level of education (undergraduate, graduate)	Difference in 3-year industry- and performance-adjusted operating ROA	Firms with CEOs of Ivy League undergraduate degree have better performance.
Education	Rakhmayil and Yuce (2008)	<i>Journal of Business & Economics Research</i> , 6 (7), 129-138	Type of education (MBA degree vs. not); Quality of education (top 25 of <i>Financial Times</i> b-school vs. not)	Tobin's q	Companies whose CEOs have MBA degrees and/or graduated from highly reputable b-school on average have significantly higher firm performance compared with the companies whose CEOs do not have these qualifications.
Education	Rakhmayil and Yuce (2013)	<i>Journal of Applied Business and Economics</i> , 14 (5), 52-70.	MBA degree vs. not; top 25 of <i>Financial Times</i> b-school vs. not	Tobin's q	Executives with MBA degree and/or graduated from highly reputable b-school on average lead to greater Tobin's q.
Education	Soriano and Castrogiovan ni (2012)	<i>Small Business Economics</i> , 38, 333-349	Type of education (industry-specific courses vs. not; general business courses vs. not)	ROA	Industry-specific knowledge possessed by CEO-owner prior to starting up the firm and the general business knowledge acquired once the firm is functioning are positively related to firm performance.
Education	Wai and Rindermann (2015)	<i>Intelligence</i> , 53, 102-107	Quality of education (elite school vs. not)	Revenue	Higher CEO education is associated with higher gross revenue of the company.
Gender	Ali and Shabir (2017)	<i>Gender in Management: An</i>	Female owner vs. not	Annual sales growth	Female- and male-owned enterprises have grown similarly in terms of annual

		<i>International Journal</i> , 32 (3), 218-233			sales at about 5% rate, and there is no significant difference in annual sales growth by gender-based ownership of the enterprises. However, the analysis of mean difference for sales growth between gender-based ownership by controlling the level of growth (i.e., firms with increasing sales growth and firms with decreasing sales growth) clearly indicates that there is no difference in sales growth across gender among the firms with declining rate of sales growth, whereas female-owned firms differ significantly from male-owned firms among the firms with increasing rate of sales.
Gender	Boohene et al. (2008)	<i>Equal Opportunities International</i> , 27 (3), 237-257	Female owner vs. not	Multiple item scales for firm performance	Ghanaian women owner-managers are more risk-averse than Ghanaian men, and this affects their pursuit of specific functional strategies and ultimately their performance in varied ways.
Gender	Cheng et al. (2010)	<i>International Business Review</i> , 19, 261-275	Female CEO vs. not	ROA; EPS; Cumulative stock returns; Cumulative abnormal returns; Ratio of market value of equity to book value of equity	Firms with female CEOs enjoy higher growth in EPS but suffer from a lower rate in ROA and growth potential than those with male CEOs.
Gender	Davis et al. (2010)	<i>Journal of Small Business</i>	Female CEO=0; Male CEO=1	Market share growth; sales growth; ROI	Female-led small and medium-sized service

		<i>Management</i> , 48 (4), 475-496			businesses (SMEs) perform significantly better than those led by males. Female-led firms are slightly better than their male-led counterparts in transmitting market performance into financial performance, although the differences were not statistically significant.
Gender	Erhardt et al. (2003)	<i>Corporate Governance</i> , 11 (2), 102-111	Proportion of females in TMT	ROI and ROA	The proportion of females on TMTs is positively associated with financial indicators of firm performance.
Gender	Francoeur et al. (2008)	<i>Journal of Business Ethics</i> , 81, 83-95	Proportion of females in TMT	Abnormal returns	Firms operating in complex environments generate positive and significant abnormal returns when they have a high proportion of women officers.
Gender	Jalbert et al. (2011)	<i>Journal of Applied Business Research</i> , 27 (1), 15-39	Male CEO=1; Female CEO=2	ROA; ROE; ROI	CEO gender is not significantly related to firm performance.
Gender	Khalife and Chalouhi (2013)	<i>International Strategic Management Review</i> , 1-10	Female owner vs. not	Gross revenue	Female-owned small firms generate lower gross revenues than those of their male counterparts.
Gender	Krishnan and Park (2005)	<i>Journal of Business Research</i> , 58, 1712-1720	Proportion of females in TMT	ROA	The proportion of female on TMTs is positively related to organizational performance.
Gender	Krishnan and Parsons (2008)	<i>Journal of Business Ethics</i> , 78, 65-76	Number of females in TMT	Annual stock returns; ROE	Companies with more females in TMT are found to be more profitable and have higher stock returns after IPO.

Gender	Lam et al. (2013)	<i>Pacific-Basin Finance Journal</i> , 21, 1136-1159	Female CEO vs. not	ROA; ROE	No significant relationship between female CEOs and firm performance.
Gender	Moscu (2013)	<i>Knowledge Horizons-Economics</i> , 5 (4), 215	Female CEO vs. not	ROA; ROE; Stock return	No significant relationship between CEO gender and firm performance.
Gender	Moreno-Gómez et al. (2018)	<i>Gender in Management: An International Journal</i> , 33 (2), 104-122	Female CEO vs. not	ROA; ROE	Female CEOs are positively associated with ROA.
Gender	Navarro and Gallo (2014)	Working paper	Female CEO vs. not	Total sales; Sales per worker; Female employment and growth of sales per worker; Employment; Productivity	The effect of women CEOs on Sales and Sales per Worker of companies is slightly negative, and significant, but the size of this effect depends on the location of the company, the size and the industry in which it is located. The impact of women CEOs on women's employment is positive and significant. The impact of CEO women in the growth rate of Sales per Worker, Employment and Productivity, the coefficient is, in general, positive and significant.
Gender	Nekhili et al. (2018)	<i>Journal of Business Ethics</i> , 153 (2), 291-316	Female CEO vs. not	ROA; Tobin's q	Female CEOs perform better in non-family firms.
Gender	Perryman et al. (2016)	<i>Journal of Business</i>	Female executive vs. not	Tobin's q	Firms with greater gender diversity in TMT deliver better performance.

		<i>Research</i> , 69 (2), 579-586			
Gender	Rahman et al. (2017)	<i>Asian Journal of Accounting and Governance</i> , 8, 27-37	Female CEO vs. not	ROE and firm market value	Female CEOs have an insignificant and significant positive relation with ROE and firm market value, respectively.
Gender	Reina et al. (2017)	<i>Organization Science</i> , 28 (2), 228–243	Female CEO vs. not	ROA	CEO gender is not significantly related to firm's ROA.
Gender	Smith et al. (2006)	<i>International Journal of Productivity and Performance Management</i> , 55 (7), 569-593.	Proportion of females in TMT	Gross profit/net sales; contribution margin/net sales; operating income/net assets; net income after tax/net assets	The proportion of females in TMT has positive effects on firm performance.
Gender	Solakoglu and Demir (2016)	<i>Management Decision</i> , 54 (6), 1407-1419	Female CEO vs. not	ROA; ROE; market returns	No significant relationship between gender and firm performance.
Gender	Strøm et al. (2014)	<i>Journal of Banking & Finance</i> , 42, 60-75	Female CEO vs. not	ROA; ROE	Female CEO is positively and significantly related to firm's financial performance.
Gender	Trinh et al. (2018)	<i>Corporate Ownership & Control</i> , 15 (2-1), 248-257	Female CEO vs. not	Tobin's q	Female CEO is negatively related to Tobin's q.
Gender	Welbourne et al. (2007)	<i>Group & Organization Management</i> , 32 (5), 524-547	Number of females in TMT	Tobin's q; Stock price; EPS	Female representation in TMT has a positive association with the firms' short-term performance, 3-year stock price growth, and growth in EPS.
Socioeconomic Background	Kish-Gephart and	<i>Academy of Management</i>	Childhood social class (lower, lower-middle,	R&D expenditures; capital expenditures;	CEOs of upper and lower social class origins engage in higher levels of strategic risk

	Campbell (2015)	<i>Journal</i> , 58 (6), 1614-1636	middle, upper-middle, and upper)	value of firm's long-term debt	taking than their middle-class counterparts.
Experience					
Tenure	Ahmadi et al. (2018)	<i>Research in International Business and Finance</i> , 44, 218-226	Number of years CEO has been in office	ROA; ROE	CEO tenure is significantly and negatively associated with firm performance.
Tenure	Allgood and Farrell (2000)	<i>Journal of Financial Research</i> , 23 (3), 373-390	Number of years CEO stays in office; New CEOs (tenure < four years), Intermediate CEOs (tenure between four and ten years), Old CEOs (tenure > ten years)	ROA; Stock returns	If ROA is the performance measure, outside CEOs appear to be entrenched during their intermediate years of tenure but are otherwise held accountable for firm performance. However, there is no relation between stock returns and the likelihood of forced turnover for CEOs hired from outside the firm.
Tenure	Afrida and Tauringana (2015)	<i>Corporate Governance</i> , 15 (5), 719-733	Number of years CEO has been in post	Tobin's q	CEO tenure is positively and significantly associated with firm performance.
Tenure	Anderson et al. (2017)	<i>Journal of Finance</i> , LXXIII (1), 419-464	Number of years CEO has run the firm	Cumulative abnormal returns; ROA; book value of total assets	Firms with better growth prospects tend to have shorter CEO tenure length.
Tenure	Antia et al. (2010)	<i>Journal of Corporate Finance</i> , 16, 288-301	Number of years the CEO has held that position	Tobin's q	Firms benefit when CEOs have a long tenure with their company.
Tenure	Bach and Lee (2018)	<i>Journal of Behavioral and Applied Management</i> , 18 (1), 3752	Number of years the senior executive has filled this position	Firm profitability and firm growth	Executive tenure is negatively related to firm growth, but not to firm profitability.

Tenure	Boeker (1997)	<i>Academy of Management Journal</i> , 40 (1), 152-170	Number of years chief executive had held the job	Strategic change: absolute percentage change in degree of diversification	TMT tenure is positively associated with greater levels of strategic change.
Tenure	Cheng et al. (2010)	<i>International Business Review</i> , 19, 261-275.	Number of years CEO stays in office	ROA; EPS; Cumulative stock returns; Cumulative abnormal returns; Ratio of market value of equity to book value of equity	Corporate performance is significantly and negatively influenced by CEO tenure.
Tenure	Cornelli et al. (2013)	<i>Journal of Finance</i> , 68 (2), 431-481	CEO turnover	Firm's subsequent performance	CEO turnover has a large, positive and significant effect on performance.
Tenure	Daellenbach et al. (1999)	<i>R&D Management</i> , 29 (3), 199-208	Number of years TMT member had worked within the industry	R&D intensity	No significant relationship between CEO tenure and R&D intensity.
Tenure	Goldsmith (2012)	Working paper	Number of years the CEO has occupied the position	ROA; ROE	CEO tenure does promote consistent, sustainable, and profitable firm performance. However, firm performance in years seven through ten was not necessarily higher than the earlier years in the performance period.
Tenure	Goll et al. (2001)	<i>Management International Review</i> , 41, 109-129	TMT tenure	ROA; ROE; return on sales (ROS); EPS	The tenure of top management has a negative relationship to firm performance.
Tenure	Kaplan and Minton (2012)	<i>International Review of Finance</i> , 12 (1), 57-87	CEO turnover	Stock returns; ROA	Internal turnover has a strong and significant relation to firm stock performance. The shorter CEO tenure, the greater sensitivity to stock performance.
Tenure	Kor (2006)	<i>Strategic Management</i>	Average number of years TMT executives have spent in a particular firm	R&D intensity	Executives' tenure is associated negatively with R&D intensity, although the

		<i>Journal</i> , 27, 1081–1099			negative effect occurs at a diminishing rate.
Tenure	Lam et al. (2013)	<i>Pacific-Basin Finance Journal</i> , 21, 1136-1159	CEO tenure in office in years	ROA; ROE	CEO tenure is positively associated with firm's performance.
Tenure	Lin et al. (2011)	<i>Journal of Comparative Economics</i> , 39, 176-190	CEO tenure in office in years	R&D intensity	CEO tenure is positively associated with firm's innovation.
Tenure	Luo et al. (2014)	<i>Strategic Management Journal</i> , 35 (4), 492–511	Number of years of CEO experience in the position	Abnormal returns	CEO tenure has a positive and linear association with firm-employee relationship strength but an inverted U-shaped association with firm-customer relationship strength; firm-employee and firm-customer relationship strength mediate the effects of CEO tenure on firm performance.
Tenure	McClelland et al. (2012)	<i>Journal of Business Research</i> , 65, 1387-1393	Number of years a CEO had occupied the CEO position	ROA	Longer CEO tenure generates lower future financial performance in dynamic industries but not in stable industries.
Tenure	Pascal et al. (2017)	<i>Small Business Economics</i> , 49, 339-354	Total number of years a CEO has been in position	ROA; ROE	CEO tenure is not significantly related to firm's ROA or ROE.
Tenure	Peni (2014)	<i>Journal of Management and Governance</i> , 14 (1), 37-59	Number of years CEO has served in the position	Tobin's q; ROA	CEO tenure is positively related to firm performance.
Tenure	Reina et al. (2017)	<i>Organization Science</i> , 28 (2), 228–243	Number of years a CEO had held the position	ROA	CEO tenure is not significantly related to firm's ROA.

Tenure	Shen and Cannella (2002)	<i>Academy of Management Journal</i> , 45 (4), 717-733	Number of years CEO has served in the position	ROA	The relationship between departing CEO tenure and post-succession firm performance is inverted U-shaped.
Tenure	Tien et al. (2013)	<i>Journal of Management & Organization</i> , 19:4, 424-453	CEO tenure in office in years	Tobin's q; ROA; ROE	No significant relationship between CEO tenure and firm performance.
Tenure	Walters et al. (2007)	<i>Journal of Business Research</i> , 60, 331-338	Number of years CEOs had held their positions	Cumulative abnormal returns	In the absence of a vigilant board, CEO tenure is positively associated with performance at low to moderate levels of tenure, and negatively associated with performance when tenure further rises to substantial levels. In the presence of a vigilant board, however, shareholder interests can be advanced even at high levels of CEO tenure.
Tenure	Westphal and Fredrickson (2001)	<i>Strategic Management Journal</i> , 22 (12), 1113-1137	Number of years director had been employed	Level of diversification	While the experience of new CEOs appears to predict corporate strategic change, these effects disappear after accounting for board experience.
Tenure	Wilkes (2014)	Working paper	CEO tenure	Cumulative abnormal returns	Only departing CEO tenure in small companies is significantly related to pre-event corporate performance, and within these small companies, CEOs of more than 15 years tenure show

					improved corporate performance.
Tenure	Wu et al. (2005)	<i>Academy of Management Journal</i> , 48 (5), 859-873	Total number of years a specific individual had held CEO position	Total number of patents	The relationship between CEO tenure and firm's inventive output is inverted U-shaped.
Tenure	Zhang and Sun (2017)	<i>Research on Modern Higher Education</i> , 2, 109-113	Tenure of TMT members	R&D investment; R&D intensity	No significant relationship between tenure of TMT members and R&D investment.
Marketing expertise	Lin et al. (2011)	<i>Journal of Comparative Economics</i> , 39, 176-190	CEOs with business experience vs. not	R&D intensity	CEO's business experience is positively associated with firm's R&D investment.
Marketing expertise	Menguc and Auh (2008)	<i>International Journal of Research in Marketing</i> , 25, 34-45	CEO background (1 = marketing/sales; 0 = all others, such as finance/accounting, R&D/operations, law)	ROA	CEO background is not significantly related to ROA.
Marketing expertise	Srinivasan et al. (2018)	<i>Journal of Marketing</i> , 82, 132-148	CEO's dominant experience in sales/marketing functions vs. not	Number of new products	Board interlock centrality increases new product introductions. This effect is stronger when firms have a marketing CEO.
Marketing expertise	Vaid and Ahearne (2018)	<i>Industrial Marketing Management</i> , 69, 185-197	CEO appointment announcement is sales and marketing, operations, or finance and accounting vs. not	Cumulative abnormal returns; Tobin's q	CEO endorsement of sales and marketing appointment announcements at firms with a heavy marketing emphasis hurts firm performance.
Marketing expertise	Weinzimmer et al. (2003)	<i>Journal of Strategic Marketing</i> , 11, 133-159	Executive with marketing expertise in TMT vs. not	Strategic market aggressiveness as an index accounting for the five-year averages of three intensity ratios: R&D expenditures to total sales, advertising	Inclusion of marketing expertise on the TMT and aggressive deployment of strategic resources for addressing markets contribute uniquely to sales growth which, in turn, contributes

				<p>expenditures to total sales, and new plant and equipment expenditures to total sales;</p> <p>Sales growth rate; Growth in profitability: divide the change in return on equity (ROE) at the end of each year of the sample period by the average ROE over the period; Shareholder value (stock price times the number of shares outstanding): divide the change in shareholder value over each year of the sample period by the average total shareholder value</p>	substantially to firm profitability and shareholder value.
Functional experience	Zhang and Sun (2017)	<i>Research on Modern Higher Education</i> , 2, 109-113	Proportion of “output function” experience	R&D investment; R&D intensity	The proportion of “output function” experience members in TMT is positively associated with R&D investment.
Duality	Adams et al. (2005)	<i>The Review of Financial Studies</i> , 18 (4), 1403-1432	CEO is chairman (and president) vs. not	Stock return; ROA; Tobin’s q	CEO duality is not significantly related to firm performance.
Duality	Ahmadi et al. (2018)	<i>Research in International Business and Finance</i> , 44, 218-226	CEO served as board chair vs. not	ROA; ROE	CEO duality is significantly and positively associated with firm performance.
Duality	Duru et al. (2016)	<i>Journal of Business</i>	CEO serves as board chair vs. not	ROA; ROE; ROS	CEO duality is statistically significantly negatively related to firm performance.

		<i>Research</i> , 69, 4269–4277			
Duality	Elsayed (2007)	<i>Corporate Governance</i> , 15 (6), 1203-1214	CEO served as board chairman vs. not	ROA; Tobin's q	<p>The impact of CEO duality varies with industry type and firm performance:</p> <p>CEO duality is positively correlated with corporate performance in five industries: Textiles & Clothing; Paper, Packaging & Plastic; Gas, Oil & Mining; Food & Beverage; and Housing & Real Estate. In contrast, CEO duality is negatively associated with corporate performance in just one industry, Cement, and has a neutral effect in the context of other industries.</p> <p>CEO duality has a significantly positive impact on performance in the low performance sub-group using either ROA or Tobin's q. In contrast, CEO duality does not appear to have any significant impact on high performance sub-groups.</p>
Duality	Hauser (2018)	<i>Journal of Financial Economics</i> , 128 (1), 16-37	Number of board seats held by the director	ROA and Tobin's q	A reduction in board appointments (generated by mergers) is associated with increased operating profits

					and higher market-to-book ratios.
Duality	Iyengar and Zampelli (2009)	<i>Strategic Management Journal</i> , 30, 1092–1112	CEO is board chair vs. not	One-year total market return to shareholders; Tobin's q; ROA; EPS	The dual leadership structure has a significant independent positive impact on market return. No significant marginal performance (measured by Tobin's q and ROA) impacts of CEO duality.
Duality	Kor (2006)	<i>Strategic Management Journal</i> , 27, 1081–1099	CEO is board chair vs. not	R&D intensity	Separating CEO and board chairperson duties is associated positively with R&D investment intensity.
Duality	Nekhili et al. (2018)	<i>Journal of Business Ethics</i> , 153, 291-316	CEO served as board chair vs. not	ROA; Tobin's q	CEO duality is positively associated with Tobin's q for nonfamily firms.
Duality	Tien et al. (2013)	<i>Journal of Management & Organization</i> , 19:4, 424–453	CEO served as board chair vs. not	Tobin's q; ROA; ROE	No significant relationship between CEO duality and firm performance.
Duality	Peni (2014)	<i>Journal of Management and Governance</i> , 14 (1), 37-59	Number of board seats held by CEO	Tobin's q; ROA	CEO duality has a positive relationship with Tobin's q and ROA of the firm.
Duality	Whitler et al. (2018)	<i>Journal of Marketing</i> , 82, 86–105	CEO also holds title of board chair vs. not	Annual revenue growth: year-over-year percentage change in annual firm revenues	The interaction effect of CEO duality and marketing-experienced board members (MEBMs) on firm revenue growth is positive and significant.
Network	Collins and Clark (2003)	<i>Academy of Management Journal</i> , 46(6), 740-751	Network size: total number of contacts in a TMT's social network; Network range: number of different groups or	Stock returns; sales growth	The range and strength of ties of external networks are significantly and positively related to sales growth and stock returns. External

			actor categories a network accesses; Strength of ties: the linear combination of the standardized scores of the three components of tie strength (interaction frequency, relationship duration, and the emotional intensity or closeness of a bond).		network size is not significantly related to firm performance. Internal network size is significantly related to sales growth but not stock returns. The range of internal network is significantly related to stock returns but not sales growth. The strength of ties of internal networks is not significantly related to firm performance.
Network	Faleye et al. (2014)	<i>Journal of Financial and Quantitative Analysis</i> , 49 (5-6), 1201-1225	Total number of individuals with whom CEO shares a common employment, educational, or social history	R&D investment and patenting activity	Firms with better-connected CEOs invest more in research and development and receive more and higher quality patents.
Network	Liang et al. (2010)	<i>Journal of Managerial Issues</i> , XXII (4), 436-45	TMT communication network density: calculated by dividing the sum of contacts actually made by the total contacts possible; TMT communication network decentralization: inverse of network centralization, which is a group-level index derived from an individual-level information centrality index	Growth and profitability	The more communication that occurs among top managers (as measured by communication network density), the greater the organization's performance. The influence of TMT communication networks on organizational performance is contingent upon the level of environmental uncertainty facing the firm. The better the fit is between intra-team communication density and environmental uncertainty,

					the better the firm's performance. Decentralized communication patterns have negative performance implications in more uncertain environment.
Network	Larcker et al. (2013)	<i>Journal of Accounting and Economics</i> , 55 (2-3), 225-250	Multi-dimensional measurement for board connectedness	ROA	Firms with the best-connected boards on average earn substantially higher future excess returns compared to firms with the worst-connected boards.
Network	Lin et al. (2011)	<i>Journal of Comparative Economics</i> , 39, 176-190	Political connection: previously employed in government agencies vs. not	R&D intensity	CEOs with political connections are more likely to make R&D investments.
Network	McDonald et al. (2008)	<i>Academy of Management Journal</i> , 51 (3), 453-475	Multi-item scale to measure CEO advice-seeking interactions	ROA; market-to-book value of equity	CEOs' advice-seeking behaviors enhance firm performance.
Network	Young et al. (2001)	<i>Strategic Management Journal</i> , 22 (10), 935-951	Patient referral network	TQM (Total Quality Management) adoption vs. not	Both top managers and network/institutional factors are important determinants of whether and when organizations adopt innovation.
Compensation					
Compensation	Aggarwal and Samwick (2006)	<i>Journal of Corporate Finance</i> , 12, 489-515	Pay-performance incentives	Tobin's q	Firm performance is increasing in incentives.
Long-term (LT) compensation	Basuroy et al. (2014)	<i>Review of Accounting and Finance</i> , 13 (4), 326-352	Sensitivity of CEO wealth from incentive-based compensation to changes in stock price	MV, Tobin's q	Sensitivity of CEO wealth from LT compensation affects firm value.

Excess compensation	Brick et al. (2012)	<i>Review of Economics and Statistics</i> , 94 (1), 287-303	Log of total compensation	Excess returns	Excess CEO compensation is associated with lower performance.
Compensation	Bushman et al. (2016)	<i>The Accounting Review</i> , 91 (1), 21-45.	Executive's PPS (Pay Performance Sensitivity)	Tobin's q and ROA	Firm performance increases when PPS dispersion is too low (negative residuals) and decreases when it is too high (positive residuals). Deviations from optimal PPS dispersion become less damaging to firm performance as the duration of a team's tenure together increases.
Compensation	Carpenter and Sanders (2002)	<i>Strategic Management Journal</i> , 23 (4), 367-375	Logging average value of total compensation	ROA; Tobin's q	TMT compensation predicts performance (i.e., return on assets and Tobin's q) when aligned with shareholder interests and internal contingencies.
CEO inside debt holdings	Cassell et al. (2012)	<i>Journal of Financial Economics</i> , 103 (3), 588-610	CEO inside debt holdings (CEO IDH)=sum of present value of accumulated pension benefits and deferred compensations	Variance of stock returns/ expected stock returns; R&D expenditures	The volatility of future firm stock returns is lower when CEO inside debt holdings are large. Negative association between CEO inside debt holdings and R&D expenditures.
Compensation	Cheng (2004)	<i>The Accounting Review</i> , 79 (2), 305-328	CEO compensation (cash & options)	R&D expenditure	Compensation committees establish a greater positive association between changes in R&D spending and changes in CEO option compensation in order to

					prevent opportunistic reductions in R&D spending.
Compensation	Coles et al. (2006)	<i>Journal of Financial Economics</i> , 79, 431–468	Sensitivity of CEO wealth; cash compensation	R&D expenditure	Higher sensitivity of CEO wealth to stock volatility is associated with more investment in R&D.
CEO underpayment	Fong (2010)	<i>Journal of Management Studies</i> , 47(6), 1095-1122	Relative total pay; relative cash pay; relative options pay	R&D expenditure	Relative CEO underpayment is associated with reductions in R&D spending in low R&D intensive industries and increases in R&D spending in high R&D intensive industries. Also, greater relative CEO underpayment leads to greater reductions in R&D spending in manager-controlled organizations as compared to owner-controlled organizations.
Dispersion pay of CEO	Fredrickson et al. (2010)	<i>Strategic Management Journal</i> , 31, 1031–1053	Pay dispersion	ROA	Pay dispersion is negatively related to company performance, particularly when it exceeded what could be justified by characteristics of the industry, firm, or team. But the strength of that relationship depends on how uniformly members of the team would benefit from subsequent performance gains. Specifically, the negative effect is particularly strong in firms where major differences in compensation—that is, some executives were given

					significantly more stock options—combined with a volatile stock price to provide only a few team members with the opportunity to realize very large financial gains in the future.
Total Compensation	Jeppson et al. (2009)	<i>Journal of Business and Economics Research</i> , 7 (11), 81-93	Base salary, cash bonus, perks, stock awards, option awards, total comp	Revenue, change in net income, change in total shareholder return	No significant relationship between CEO compensation and firm performance. The exception is total revenue, but with a very weak relationship.
CEO Incentives	Makri et al. (2006)	<i>Strategic Management Journal</i> , 27(11), 1057-1080	CEO's annual bonus; long-term income	Market-to-book ratio; ROE; number of times a firm's previous five years of patents are cited in the current year; number of references in the firm's own patent applications to scientific papers	As technological intensity increases, CEO bonuses are more closely linked to financial results and that total CEO incentives are associated with two indicators of desirable innovation behaviors: invention resonance and science harvesting.
LT and ST incentives	Manso (2011)	<i>Journal of Finance</i> , 66(5), 1823-1860	Analytical model		Optimal innovation motivating scheme includes tolerance for ST failure, and rewards for LT success. Ideal combination is LT stock options, golden parachutes, managerial entrenchment.
Compensation	Michaud and Gai (2009)	Working paper	CEO pay	ROE	CEO pay is not related to firm performance.
Compensation	Palia (2001)	<i>Review of Financial Studies</i> , 14 (3), 735-764	CEO's pay-performance sensitivity	Tobin's q	Shareholder incentive-compatible compensation is not statistically significantly related to firm value.

TMT pay	Siegel and Hambrick (2005)	<i>Organization Science</i> , 16 (3), 259-274	TMT pay disparity	Average relative market-to-book; Average relative total shareholder returns	The more technologically intensive the industry, the more harmful for subsequent corporate performance was the presence of (1) vertical pay disparities between executive levels; (2) horizontal pay disparities within an executive level; (3) overall pay disparity within the TMT.
ST pay LT pay Total compensation	Tien et al. (2013)	<i>Journal of Management & Organization</i> , 19:4, 424–453	ST pay: base pay plus bonuses; LT pay: stocks, options, and all other contingent pay; Total compensation: sum of short-term pay and long-term pay	Tobin's q; ROA; ROE	CEO short-term pay positively impacts a firm's ROA and international performance but negatively impacts its market value. CEO total pay positively impacts a firm's ROA and international performance.
Compensation monitoring	Tosi and Gomez-Mejia (1994)	<i>Academy of Management Journal</i> , 37 (4), 1002-1016	CEO monitoring scale	EPS, ROI, Return on common stock, MV	Firm performance related to firm monitoring of CEO compensation, with decreasing returns to scale.
LT incentives	Xue (2007)	<i>Review of Accounting Studies</i> , 12 (4), 659-690	Current bonus/total compensation; share price sensitivity	Purchased technology = intangibles + goodwill + amortization of intangibles + amortization of goodwill	TMTs with more stock-based compensation will be more likely to create risky innovation in-house than acquire or buy it from outside.
CEO compensation satisfaction	Zajac (1990)	<i>Strategic Management Journal</i> , 11 (3), 217-230	CEO salary satisfaction survey	Firm profitability	Firms whose CEOs are more satisfied with their compensation will be higher performing.