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1. INTRODUCTION

The role of Chief Executive Officers (CEOs) in shaping organizational strategy and outcomes has been a focal point of research in strategic management and organizational theory (e.g., Vincent et al., 2003; Bamber et al., 2010; Bonsu & Yawson, 2023). CEOs' decisions are pivotal in influencing firm operations and growth trajectories (Chatterjee & Hambrick, 2011; Quigley & Hambrick, 2015; Quigley & Graffin, 2017). While initial studies predominantly focused on CEOs' demographic attributes, such as age, tenure, and gender (e.g., Belenzon et al., 2019; Kish-Gephart & Campbell, 2015), recent research has shifted towards exploring the impact of CEOs' personality traits, including hubris, overconfidence, humility, Machiavellianism, and narcissism, on organizational outcomes (e.g., Ho et al., 2016; Waldman & Peterson, 2018; Recendes et al., 2022; Kashmiri et al., 2017).

Innovation, as a critical driver of competitive advantage and corporate growth (Prajogo & Ahmed, 2006), has been linked to CEO characteristics. However, the relationship between CEO narcissism and firm innovation remains underexplored and presents inconsistent findings in a very limited relevant studies (e.g., Nie et al., 2022; Kashmiri et al., 2017; Kraft, 2022; Yang et al., 2021). These inconsistencies may stem from a lack of in-depth analysis of the mechanisms underlying this relationship. Our study aims to bridge this gap by examining not only the direct impact of CEO narcissism on innovation performance but also the mediating pathways through which narcissistic CEOs influence firm innovation.

Building on upper echelons theory (Hambrick & Mason, 1984), we propose that narcissistic CEOs, driven by a desire for visibility and attention, may prioritize R&D investments to maintain their influence and support firm growth (e.g., Ham et al., 2018; Cragun et al., 2020). Additionally, we explore the moderating role of CEO career horizon, suggesting that the impact of narcissism on innovation may vary depending on the CEO's proximity to retirement. This nuanced approach responds to calls for a more comprehensive understanding of the interplay between CEO characteristics and firm outcomes (Busenbark et al., 2016).

2. THEORETICAL FRAMEWORK

2.1 Upper echelons theory

According to the UET, the experiences, values, and characters of CEOs or top executives profoundly influence their strategic decisions, which, in turn, have significant ramifications for organizational outcomes (Hambrick and Mason, 1984; Hambrick, 2007). The cognitive views and characteristics of executives significantly influence all facets of strategic decision-making, from issue identification to tangible corporate actions like product innovation and corporate social responsibility (Petrenko,

Aime, Ridge & Hill, 2016).

However, despite extensive research into the CEO attributes through the lens of UET over the past decades, voices within the academic community continue to highlight certain limitations of this framework. Specifically, there is concern that UET may not delve deeply enough into the mechanisms driving narcissistic behavior (Cragun et al., 2020). Also, it may lack an adequate framework to explore potential factors that could amplify or mitigate the impacts of narcissistic tendencies (Busenbark et al., 2016; Cragun et al., 2020). Therefore, it is important to advance UET by taking a more nuanced approach.

2.2 CEO narcissism

The concept of CEO narcissism is a multi-layered construct that has evolved over time, both historically and psychologically. It has moved from being a clinical disorder to a cultural phenomenon and, most recently, to a recognized personality trait (Vazire & Funder, 2006). This historical evolution provides a backdrop for understanding the psychological intricacies of narcissism, particularly among CEOs. Narcissism manifests as a complex blend of cognitive and motivational elements (Campbell & Miller, 2011). CEOs with narcissistic tendencies often exhibit a grandiose sense of self and entitlement, coupled with a dominant interpersonal style (Gentile et al., 2013). Cognitively, they are prone to overestimating their abilities, diverging significantly from objective assessments (Judge et al., 2006; Robins & John, 1997). They are prone to view positive feedback from the organization as endorsements of their own personal qualities, while negative feedback is not seen as a result of their own decisions and behaviors. Motivationally, individuals work to maintain a self-image consistent with how they wish to be perceived (Goffman, 1959), which is called the public self—the self that is manifested when around others (Baumeister, 1986). For narcissists, the construction of this public self is particularly important as they seek continuous external affirmation to sustain their inflated self-view (Morf & Rhodewalt, 2001). Thus, behaviorally, narcissists seek to capture the spotlight (Wale et al., 2013) and are driven to achieve grandiose accomplishments yet their approach to self-enhancement opportunities can be reckless (Olsen, Dworkis & Young, 2014).

2.3 CEO narcissism and innovation performance

Innovation performance in the study is defined as “the development and market introduction of a new, redesigned or substantially improved products (Wang, Kafouros, Yi, Hong & Ganotakis, 2020). Some researchers argue that the personality traits of CEOs are largely irrelevant in shaping innovation outcomes (Christensen, 1997). Prior literature suggests that leader narcissism might be detrimental to innovation because leader narcissism negatively influences their employees’ innovative behaviors (Yang et al., 2020). According to Enkel and Heil (2014), firm innovation contains two dimensions: explorative innovation and exploitative innovation. Nie et al., (2022) study

the effects of CEO narcissism on the two types of innovation and the evidence show that CEO narcissism has no significant effect on explorative innovation but negatively affects exploitative innovation. This is because narcissistic CEOs tend to ignore their subordinates or colleagues and belittle them to get self-approval due to a sense of superiority and power (Back et al., 2013; Fung et al., 2020) and therefore their followers such as R&D teams are less willing to take their responsibilities to implement their ideas and change the status quo.

Nevertheless, we suggest that there is a positive relationship between CEO narcissism and firm innovation. There are some reasons that CEO narcissism might improve innovation. Firstly, narcissistic CEOs are primarily interested in “getting ahead” instead of “getting along” (Paulhus & John, 1998) and greatly desire confirmation of their power and superiority (Bogart, Benotsch & Pavlovic, 2004). Narcissistic leaders find themselves more intelligent and attractive than others, have a sense of superiority (Bogart et al., 2004; Chatterjee & Hambrick, 2007).

Firstly, the personal desire to stand out and the pursuit of growth and expansion for the firm motivate narcissistic CEOs to pursue innovation and pioneering as a means of attracting public attention and fostering adoration among followers, as well as enhancing the leader’s power and influence (Wales et al., 2013). Prior research has indicated that products with innovative design receive more media coverage and are more frequently discussed by experts (Micheli & Gemser, 2016). Therefore, narcissistic CEOs are likely to actively engage in firm innovation activities to attract media attention and admiration.

Secondly, managing innovation activities entails considerable risk for firms (e.g., Baldwin & von Hippel, 2011; Smith & Tushman, 2005). Although risk-taking can potentially lead to negative outcomes, such as severe financial constraints (Zhang, 2015), CEOs aiming to enhance innovation performance and firm growth must opt to take strategic risks. Given that highly narcissistic individuals are inclined to risk-taking, this propensity can be attributed to traits inherent in narcissistic personalities, such as arrogance, self-absorption (Emmons, 1987) and an inflated sense of self (Back et al., 2013). Thus, they are likely to overlook objective cues about future prospects (Chatterjee & Hambrick, 2011) and to engage in bold, risk-taking behaviors. For example, Kashmiri et al. (2017) suggest that firms led by narcissistic CEOs naturally inclined to embrace risks tend to demonstrate a higher rate of new product introductions and a greater proportion of radical innovations in their new product portfolios. These radical innovations, as integral components of firm innovation performance, play a significant role in the long-term success of firms (McDermott & O'Connor, 2003). Therefore, the following hypothesis is proposed:

Hypothesis 1 (baseline hypothesis): CEO narcissism positively influences innovation performance.

2.4 The mediating role of R&D intensity

The commitment to R&D is a vital determinant of a firm's survival and growth, as it fosters problem-solving and knowledge generation (Lee et al., 2014), and sustains competitiveness in a dynamic market (Coad & Rao, 2008). A positive relationship between R&D intensity and innovation performance has been established in the literature, highlighting the pivotal role of R&D investment in driving innovation (Dong et al., 2021).

While previous studies have explored the direct effects of CEO narcissism on firm outcomes, the underlying mechanisms remain underexplored. Research suggests that CEO personality traits, such as narcissism, influence organizational performance through strategic decisions (Kiss et al., 2022). In line with upper echelons theory, we propose that narcissistic CEOs are likely to promote behaviors that enhance firm R&D intensity, thereby positively impacting innovation performance. This assertion is supported by literature emphasizing the mediating role of strategic actions in the relationship between CEO personality and firm outcomes (Kiss et al., 2022).

R&D investment, as a strategic decision, reflects the CEO's discretion in shaping firm strategy (Mitchell & Hamilton, 1988). CEOs' strategic awareness and personality traits significantly influence innovation decision-making (Karami et al., 2006). Despite the inherent risks associated with R&D activities, these investments are crucial for generating long-term profits and recognition (Kothari et al., 2002). Narcissistic CEOs, characterized by excessive self-confidence and a sense of superiority (Emmons, 1987; Back et al., 2013), tend to have positively biased expectations regarding their decisions' outcomes (Chatterjee & Hambrick, 2011). This mindset predisposes them to embrace high-risk behaviors and make significant investments in R&D activities, viewing them as opportunities to garner applause and reinforce their public image (Buyl et al., 2017; Chatterjee & Hambrick, 2011).

Furthermore, narcissistic CEOs' need for acclaim and admiration (Back et al., 2013) motivates them to seek opportunities that reaffirm their inflated sense of self (Emmons, 1984). They often associate with high-status individuals or teams to enhance their social and firm status (Hambrick & Pollock, 2017). Consequently, they may allocate more resources to hire renowned R&D teams, whose prominence is a marker of their historical performance (Benjamin & Podolny, 1999). These teams possess superior knowledge and skills essential for R&D, thereby improving research efficiency and innovation performance.

Based on these arguments, we propose the following hypothesis:

Hypothesis 2: CEO narcissism has a positive indirect influence on a firm's innovation performance, mediated by its impact on R&D intensity.

2.5 The moderating effect of situational characteristic

In the existing literature on CEO narcissism, narcissism is regarded as a personality trait. Personality traits are typically seen as stable and do not change over time (Digman, 1989), which leads to predictable behaviors and motivations (Miller & Campbell, 2008). Thus, researchers can measure narcissism at any point and then assume that it remains unchanged (e.g., Chatterjee & Hambrick 2007, 2011; Olsen & Stekelberg, 2016; Zhu & Chen, 2015a). However, it should be noted that both behaviors and motivations can stem from an interplay of inherent personality traits and situational influences (Pervin & John, 1999). Cragun et al. (2020) suggest that the impact of CEO narcissism may vary depending on situational factors and call for future research to explore factors that may amplify or dampen CEO narcissistic behaviors, including CEO attributes and the organizational environment. For example, You et al. (2023) analyze how CEO narcissism affects firm innovation ambidexterity and further highlight how varying levels of CEO power and firm reputation serve as situational factors that constrain the behavioral manifestation of CEO narcissism.

2.5.1 The moderating of CEO career horizon

The stability of CEO narcissistic traits over time does not preclude the influence of situational factors on decision-making preferences and behaviors. Among these, the CEO career horizon—time remaining until retirement—is significant (Biru et al., 2023;). This factor profoundly impacts a CEO's psychological outlook and, consequently, their strategic and operational decisions within the company (Bilgili et al., 2020). CEO career horizon reflects not only age but also a CEO's experience and network, which are vital to R&D and innovation processes.

We posit that CEO career horizon moderates the nexus between CEO narcissism and innovation performance. Narcissistic CEOs who believe in their superiority over others and consistently seek acclaim and applause have very limited time to correct mistakes and repair image damage caused by failures when facing the impending end of their careers. Therefore, as R&D could lead to public failures and challenge their personal capabilities, they are likely to reduce their involvement in R&D activities with high risks and uncertainty to protect their legacy and already established positive and inflated self-image.

Conversely, a shorter CEO career horizon can signify greater intellectual capabilities and a more extensive network, both of which enhance innovation management and performance (Sitthipongpanich & Polsiri, 2015). Richer networks, often forged from elite institutions, bolster the firm's knowledge absorption and innovation capabilities (Konstantinos et al., 2011). Hence, we propose:

Hypothesis 3 (a, b): CEO career horizon positively moderates the relationship between CEO narcissism and R&D intensity (a), but negatively moderates the relationship between R&D intensity and innovation performance (b).

3 METHODS

3.1 Data and Sample

Our sample includes all firms in high-tech industry listed on the Shanghai and Shenzhen Stock Exchanges from 2013 to 2019. Data on CEO characteristics and firm-level data were obtained from the China Stock Market & Accounting Research Database (CSMAR) and CNRDS database. Also, using the CNINF and the official websites of the firms, we manually collected the data about CEO narcissism. After merging these datasets and excluding missing values, our final sample was composed of an unbalanced panel data from 566 firms.

3.2 Measures

Independent variable

Studying executive personality presents considerable challenges, particularly due to data constraints. Top executives, especially those leading public firms, are often reluctant to participate in extensive psychological assessments (Cycyota & Harrison, 2006). While analyzing published biographies is an option, it comes with its own set of limitations. A more viable approach is to employ unobtrusive measures of personality and further elaborated by Chatterjee and Hambrick (2011). Therefore, we measure CEO narcissism based on two distinct ways.

First, we follow the studies of Chatterjee and Hambrick (2007) and Chatterjee and Hambrick (2011), CEO narcissism index will be measured by the five indicators.⁴ Also, in line with the methodologies employed by Ham et al. (2018), we adopt an alternative approach to measure CEO narcissism by analyzing the size and content of a CEO's signature in official firm documents for robustness checks.

Dependent variable

Consistent with the approach of Dang & Motohashi (2015), this study utilizes the number of patent applications by firms to proxy innovation performance, as we believe this measure provides an immediate reflection of a firm's innovative activities. Patent applications directly showcase the innovation efforts of a firm without the delay of the complete patent examination and granting process. We will use the number of granted patents as an alternative dependent variable for robustness checks.

*Note*⁴ (1) The prominence of the CEO's photographs in the company's annual reports; (2) The frequency with which the CEO is mentioned in corporate press releases, normalized by the total word count of all such releases (similar outcomes are observed when the total number of press releases serves as the denominator); (3) The ratio of first-person singular pronouns used by the CEO to the total number of first-person pronouns in interview transcripts; (4) The CEO's cash compensation compared to those of the second highest-paid corporate manager; (5) The CEO's non-cash compensation compared to those of the second highest-paid corporate manager.

Mediating variable

In accordance with prior studies (e.g., Guzzini & Iacobucci, 2014), the research employs the ratio of R&D expenditure to sales revenue as a measurement.

Moderating variable

CEO career horizon, the pre-retirement phase of a CEO's tenure, has traditionally been measured crudely by age alone, setting a cutoff at various points from 60 to 65 years (Brickley et al., 1999). Our study adopts a more sophisticated measure in the vein of Lee et al. (2018), integrating CEO age with tenure against the backdrop of industry standards. By assessing both age and tenure relative to industry averages, our methodology provides a more contextualized gauge of CEO career horizon. Thus, the CEO career horizon measurement utilized in our study evaluates CEOs within the same industry by examining two aspects: current age and the length of tenure:

$$CEO\ career\ horizon_{i,y} = [CEOage_{ind\ avg,y} - CEO\ age_{i,y}] + [CEOtenture_{ind\ avg,y} - CEOtenture_{i,y}]. \quad (1)$$

Greater values of this measurement indicate longer CEO career horizons.

Control variables

We include control variables related to both the firm and CEO-levels in our analytical framework. As for the firm-level variables: firm size, firm age, firm size, firm leverage (ROA) and firm's profitability (ROE). Also, we control CEO-specific variables related to innovation performance including CEO educational background, CEO gender, CEO overseas background, CEO political ties and CEO duality.

3.3. Empirical method

In our research, we analyzed our data using Ordinary Least Squares (OLS) regression with fixed effects. Fixed or random effects estimations are typically used for panel data analysis like ours. Initially, we conducted a Hausman specification test to determine the suitability of fixed or random effects models. The test's rejection of the null hypothesis, indicated by a p-value of less than 0.1, suggests that the fixed effects model is more appropriate for estimation (Hausman, 1978), leading us to employ the fixed effects model. Secondly, we utilized OLS regression to analyze data. Additionally, we conducted robustness checks with various model specifications and estimation techniques (please see below).

4 RESULTS

4.1 Descriptive statistics and correlation matrix

Table 1 presents the descriptive statistics and correlation matrix for each variable, including mean, standard deviation, minimum value, median, and maximum value. The variance inflation factors (VIFs) results from the Stata output indicate that the values range from a minimum of 1.01 to a maximum of 1.48. The mean VIF is 1.14, indicating a very low average correlation between the independent variables. This confirms that multicollinearity is not likely to be influencing the estimates in the model.

[Insert Table 1 here]

4.2 Regression results

Table 2 reports the baseline regression results between CEO narcissism and innovation performance. Columns (2), (3), and (4) progressively incorporate control variables based on Column (1). The regression results continue to show that the coefficient between CEO narcissism and Patent is significantly positive. This result provides support for Hypothesis 1, which predicts that CEO narcissism positively influence innovation performance.

[Insert Table 2 here]

The regression results of the mediating effect of the level of R&D intensity are presented in Table 3. As shown in Column (2), the regression coefficient for CEO narcissism with respect to R&D intensity is positive, indicating that CEO narcissism increases the intensity of firm R&D. The results in Column (3) reveal that the regression coefficient for R&D intensity with respect to innovation performance (Patent) is 2.974 and is significantly positive at the 1% level. This suggests that an increase in R&D intensity promotes corporate innovation. Therefore, Hypothesis 2 is supported that the mediating effect of R&D intensity is confirmed; CEO narcissism enhances firm innovation by increasing the level of R&D intensity.

[Insert Table 3 here]

Table 4 presents the results of the Bootstrap test for the mediating effect, where resampling is conducted 1,000 times on the overall sample. The test results for the coefficients obtained from the 1,000 samples are shown in Table 4. The p-value for the indirect effect test is 0.031, and the confidence interval is (0.007622, 0.159482), which does not include zero. This indicates that under Bootstrap testing, the mediating effect of R&D intensity is supported. Table 5 reports the moderating effect of CEO career horizon. Column (2) adds control variables based on Column (1), and the regression coefficient for CEO narcissism×CEOcareer horizon with respect to become 0.00013,

which is significantly positive at the 5% level, confirming the above conclusion. The results in Column (3) show that the regression coefficient for the interaction term R&D intensity×CEO career horizon is -0.035, which is significantly negative at the 1% level, indicating that CEO career horizon weaken the positive relationship between R&D intensity and innovation. After incorporating all control variables in Column (4), the above conclusions still hold. Hence, Hypotheses 3(a) and 3(b) are both supported.

[Insert Table 4 here]

[Insert Table 5 here]

4.3 Robustness checks

First, to further assess the robustness of the baseline regression, the measurement method for the dependent variable is changed. The level of innovation is measured using the natural logarithm of the number of patents granted plus one (Patent1) The regression results are presented in Column (1) of Table 6, and the baseline conclusions still hold. Second, CEO narcissism is also measured using the size of their signatures. The data on signature size was manually collected and analyzed using Python. The natural logarithm of 'signature_1' plus one is used as an alternative variable for CEO narcissism. The regression results are shown in Column (2) of Table 6, and the aforementioned conclusions still hold. Third, an additional control variable for overconfidence is included in the regression. The results are presented in Column (3) of Table 6, and the initial conclusions remain valid, further confirming the robustness of the empirical results.

[Insert Table 6 here]

To further mitigate the impact of unobservable factors at the CEO individual level on the empirical results, CEO fixed effects are additionally controlled for. The regression results are presented in Column (1) of Table 7. Moreover, there could still be unobserved macro-level factors at the provincial and city levels that vary across different years for firms, thereby resulting in omitted variable bias. To address this, further controls are added for province-year and city-year interaction fixed effects. The results are shown in Columns (2) and (3) of Table 7, and the initial conclusions remain valid.

[Insert Table 7 here]

4.4 Mitigating endogeneity

To further mitigate endogeneity in the model, the average value of CEO narcissism (Nar) for firms located in the same prefecture-level city is used as an instrumental variable (IV) in a 2SLS regression. The estimation results are presented in Columns (3) and (4) of Table 8. The first-stage regression results show that the IV is significantly positively correlated with CEO narcissism, satisfying the relevance assumption for the instrumental variable. The second-stage regression results indicate that, after accounting for endogeneity, the coefficient for Nar remains significantly positive. This suggests that the conclusion still holds after ruling out reverse causality. Additionally, the Wald test statistic for the instrumental variable is 891.967, rejecting the weak instrument hypothesis and validating the appropriateness of the chosen IV.

[Insert Table 8 here]

5 DISCUSSION AND CONCLUSION

Drawing on upper echelons theory, we propose that CEO narcissism impacts innovation through the adjustment of R&D intensity. We argue and find that firms led by narcissistic CEOs tend to have higher R&D intensity because narcissistic CEOs have a strong sense of superiority regarding their abilities and are inclined to a future-oriented optimism, potentially increasing R&D investments. Additionally, motivated by a desire for admiration, they may invest more to hire renowned R&D teams to gain attention and applause. Consistent with these expectations, CEO narcissism is positively related to innovation performance, with R&D intensity serving as a mediating variable. We also find that narcissistic CEOs with shorter career horizon (nearing retirement) are likely to decrease R&D intensity due to their grandiose but fragile self-view, lacking sufficient time to mitigate the potential negative impacts of R&D failures on both their public self and the firm. Moreover, the shorter the CEO career horizon, the stronger the positive relationship between R&D intensity and innovation performance, because a shorter horizon implies older age, enhanced intellectual capabilities, and a richer network, positively affecting the firm's absorptive capacity and thus the efficiency of transforming R&D intensity into innovation performance.

5.1. Theoretical contributions

First, our research contributes to the scarce literature on the between CEO narcissism and firms' innovation performance. There is a limited direct examination of how firms led by narcissistic CEOs perform in terms of innovation performance. Even though some studies have tangentially touched upon the relationship between CEO narcissism and firm innovation, their findings diverge. Some posit a positive effect on new product innovation (Kashmiri et al., 2017), while others report adverse outcomes for different innovation types (You et al., 2023; Nie et al., 2022). Drawing on the UET, we propose

R&D intensity as a critical mediating factor that could be influenced by CEO narcissism to boost innovation. This study also addresses the impact of narcissism measurement criteria on innovation performance, utilizing both the CEO Narcissism Index and signature size in our analysis, confirming that CEO narcissism fosters innovation regardless of the metric used.

Furthermore, we deepen insights into CEO narcissism's situational context and its interaction with CEO career horizon. While contrasting CEO traits such as humility, celebrity, and materialism may influence narcissistic behavior (Zhang, Ou, Tsui & Wang, 2017; Hayward, Rindova & Pollock 2004; Davidson, Dey & Smith, 2019), our introduction of CEO career horizon as a moderator clarifies its effect on the relationship between CEO narcissism, R&D intensity, and innovation performance. We discover that narcissistic CEOs with shorter career horizons tend to maintain the status quo and invest less in R&D, yet their experience heightens innovation efficiency. The study thus helps explain when a narcissistic CEO's behavior manifests or reduces and furthers understanding of moderating factors of CEO narcissism through building a more nuanced approach to CEO narcissism (Cragun et al., 2020).

5.2 Practical contributions

First, given the superior sense of ability and the desire for attention and praise inherent in narcissistic CEOs, narcissistic CEOs tend to increase R&D investment, favoring well-known teams for their self-image. Boards must align such investments with long-term goals and ensure oversight to prevent excess driven by self-promotion. Also, the findings reveal that narcissistic CEOs with short career horizons may reduce R&D intensity but may improve the R&D efficiency. When recruiting or evaluating older, narcissistic CEO candidates, boards should recognize that the CEOs may lower R&D intensity yet enhance efficiency. Boards should balance the benefits of older CEOs' knowledge and networks against their potentially conservative R&D approaches, instituting mechanisms that incentivize R&D risk-taking to encourage ongoing innovation and growth.

5.3 Limitation and future research

The research has limitations that should provide opportunities for future research. First, this study, focusing on the high-tech industry in China, highlights the influence of CEO narcissism on innovation. However, its applicability to other emerging economies with differing institutional frameworks remains uncertain. Future research should investigate whether our findings and conceptual framework extend to the manufacturing sectors in these economies. Additionally, while we examined R&D intensity as a mediator between CEO narcissism and innovation, the role of other factors such as organizational culture and decision-making processes warrants further exploration. Subsequent studies should include these mediators for a more

comprehensive understanding of the underlying dynamics.

REFERENCES

- Back, M. D., Küfner, A. C., Dufner, M., Gerlach, T. M., Rauthmann, J. F., & Denissen, J. J. (2013). Narcissistic admiration and rivalry: Disentangling the bright and dark sides of narcissism. *Journal of Personality and Social Psychology*, 105(6), 1013.
- Baumeister, R. F. (1986). Public self and private self. New York: Springer-Verlag.
- Belenzon, S., Shamshur, A., & Zarutskie, R. (2019). CEO's age and the performance of closely held firms. *Strategic Management Journal*, 40(6), 917-944.
- Benjamin, B. A., & Podolny, J. M. (1999). Status, quality, and social order in the California wine industry. *Administrative Science Quarterly*, 44(3), 563-589.
- Bilgili, H., Campbell, J. T., O'Leary-Kelly, A., Ellstrand, A. E., & Johnson, J. L. (2020). The final countdown: Regulatory focus and the phases of CEO retirement. *Academy of Management Review*, 45(1), 58-84.
- Biru, A., Filatotchev, I., Bruton, G., & Gilbert, D. (2023). CEOs' regulatory focus and firm internationalization: The moderating effects of CEO overconfidence, narcissism and career horizon. *International Business Review*, 32(3), 102078.
- Bogart, L. M., Benotsch, E. G., & Pavlovic, J. D. P. (2004). Feeling superior but threatened: The relation of narcissism to social comparison. *Basic and Applied Social Psychology*, 26(1), 35-44.
- Brickley, J. A., Linck, J. S., & Coles, J. L. (1999). What happens to CEOs after they retire? New evidence on career concerns, horizon problems, and CEO incentives. *Journal of Financial Economics*, 52(3), 341-377.
- Buyl, T., Boone, C., & Wade, J. B. (2019). CEO narcissism, risk-taking, and resilience: An empirical analysis in US commercial banks. *Journal of Management*, 45(4), 1372-1400.
- Chatterjee, A., & Hambrick, D. C. (2007). It's all about me: Narcissistic chief executive officers and their effects on company strategy and performance. *Administrative Science Quarterly*, 52(3), 351-386.
- Chatterjee, A., & Hambrick, D. C. (2011). Executive personality, capability cues, and risk taking: How narcissistic CEOs react to their successes and stumbles. *Administrative Science Quarterly*, 56(2), 202-237.
- Christensen, C. M. (1997). Marketing strategy: Learning by doing. *Harvard Business Review*, 75(6), 141-151.
- Cho, S. Y., & Kim, S. K. (2017). Horizon problem and firm innovation: The influence of CEO career horizon, exploitation, and exploration on breakthrough innovations. *Research Policy*, 46(10), 1801-1809.
- Cragun, O. R., Olsen, K. J., & Wright, P. M. (2020). Making CEO narcissism research great: A review and meta-analysis of CEO narcissism. *Journal of Management*, 46(6), 908-936.
- Davidson, R. H., Dey, A., & Smith, A. J. (2019). CEO materialism and corporate social responsibility. *The Accounting Review*, 94(1), 101-126.
- Dang, J., & Motohashi, K. (2015). Patent statistics: A good indicator for innovation in China? Patent subsidy program impacts on patent quality. *China Economic Review*, 35, 137-155.
- Digman, J. M. (1989). Five robust trait dimensions: Development, stability, and utility. *Journal of Personality*, 57(2), 195-214.
- Dong, Q., Wu, Y., Lin, H., Sun, Z., & Liang, R. (2022). Fostering green innovation for corporate competitive advantages in big data era: The role of institutional benefits. *Technology Analysis & Strategic Management*, 1-14.
- Emmons, R. A. (1984). Factor analysis and construct validity of the Narcissistic Personality Inventory. *Journal of Personality Assessment*, 48(3).
- Emmons, R. A. (1987). Narcissism: Theory and measurement. *Journal of Personality and Social Psychology*, 52(1), 11-17.
- Fung, H., Qiao, P., Yau, J., & Zeng, Y. (2020). Leader narcissism and outward foreign direct investment: Evidence

- from Chinese firms. *International Business Review*, 29(1).
- Guzzini, E., & Iacobucci, D. (2014). Ownership as R&D incentive in business groups. *Small Business Economics*, 43, 119-135.
- Ham, C., Seybert, N., & Wang, S. (2018). Narcissism is a bad sign: CEO signature size, investment, and performance. *Review of Accounting Studies*, 23(1), 234-264.
- Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review*, 9(2), 193-206.
- Hambrick, D. C., Geletkanycz, M. A., & Fredrickson, J. W. (1993). Top executive commitment to the status quo: Some tests of its determinants. *Strategic Management Journal*, 14(6), 401-418.
- Hambrick, D. C., & Pollock, T. G. (2017). Master of puppets: How narcissistic CEOs construct their professional worlds. *Academy of Management Review*, 42(4), 703-725.
- Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica: Journal of the Econometric Society*, 1251-1271.
- Hayward, M. L., Rindova, V. P., & Pollock, T. G. (2004). Believing one's own press: The causes and consequences of CEO celebrity. *Strategic Management Journal*, 25(7): 637-653.
- Miller, J. D., & Campbell, W. K. (2008). Comparing clinical and social-personality conceptualizations of narcissism. *Journal of Personality*, 76(3): 44
- Kafourous, M., Wang, C., Piperopoulos, P., & Zhang, M. (2015). Academic collaborations and firm innovation performance in China: The role of region-specific institutions. *Research Policy*, 44(3), 803-817.
- Kashmiri, S., & Brower, J. (2016). Oops! I did it again: Effect of corporate governance and top management team characteristics on the likelihood of product-harm crises. *Journal of Business Research*, 69(2), 621-630.
- Kashmiri, S., Nicol, C. D., & Arora, S. (2017). Me, myself, and I: Influence of CEO narcissism on firms' innovation strategy and the likelihood of product-harm crises. *Journal of the Academy of Marketing Science*, 45(5), 633-656.
- Karami, A., Analoui, F., & Korak Kakabadse, N. (2006). The CEOs' characteristics and their strategy development in the UK SME sector: An empirical study. *Journal of Management Development*, 25(4), 316-324.
- Kim, J. (2022). Innovation failure and firm growth: Dependence on firm size and age. *Technology Analysis & Strategic Management*, 34(2), 166-179.
- Kiss, A. N., Cortes, A. F., & Herrmann, P. (2022). CEO proactiveness, innovation, and firm performance. *The Leadership Quarterly*, 33(3), 101545.
- Kothari, S. P., Laguerre, T. E., & Leone, A. J. (2002). Capitalization versus expensing: Evidence on the uncertainty of future earnings from capital expenditures versus R&D outlays. *Review of Accounting Studies*, 7(4), 355-382.
- Kraft, P. S. (2022). The double-edged sword of CEO narcissism: A meta-analysis of innovation and firm performance implications. *Journal of Product Innovation Management*, 39(6), 749-772.
- Lee, C. Y., Wu, H. L., & Pao, H. W. (2014). How does R&D intensity influence firm explorativeness? Evidence of R&D active firms in four advanced countries. *Technovation*, 34, 582-593.
- Lee, J. M., Park, J. C., & Folta, T. B. (2018). CEO career horizon, corporate governance, and real options: The role of economic short-termism. *Strategic Management Journal*, 39(10), 2703-2725.
- McDermott, C. M., & O'Connor, G. C. (2002). Managing radical innovation: An overview of emergent strategy issues. *Journal of Product Innovation Management*, 19(6), 424-438.
- Micheli, P., & Gemser, G. (2016). Signaling strategies for innovative design: A study on design tradition and expert attention. *Journal of Product Innovation Management*, 33(5), 613-627.
- Mitchell, G. R., & Hamilton, W. F. (1988). Managing R&D as a strategic option. *Research Technology Management*, 31(3), 15-22.

- Nie, X., Yu, M., Zhai, Y., & Lin, H. (2022). Explorative and exploitative innovation: A perspective on CEO humility, narcissism, and market dynamism. *Journal of Business Research*, 147, 71-81.
- Olsen, K. J., Dworkis, K. K., & Young, S. M. (2014). CEO narcissism and accounting: A picture of profits. *Journal of Management Accounting Research*, 26(2), 243-267.
- Olsen, K. J., & Stekelberg, J. (2016). CEO narcissism and corporate tax sheltering. *The Journal of the American Taxation Association*, 38(1): 1-22.
- Petrenko, O. V., Aime, F., Ridge, J., & Hill, A. (2016). Corporate social responsibility or CEO narcissism? CSR motivations and organizational performance. *Strategic Management Journal*, 37(2), 262-279.
- Pervin, L. A., & John, O. P. 1999. *Handbook of personality: Theory and research*, 2.
- Prajogo, D. I., & Ahmed, P. K. (2006). Relationships between innovation stimulus, innovation capacity, and innovation performance. *R&D Management*, 36(5), 499-515.
- Quigley, T. J., & Hambrick, D. C. (2015). Has the “CEO effect” increased in recent decades? A new explanation for the great rise in America's attention to corporate leaders. *Strategic Management Journal*, 36(6), 821-830.
- Quigley, T. J., & Graffin, S. D. (2017). Reaffirming the CEO effect is significant and much larger than chance: A comment on Fitza (2014). *Strategic Management Journal*, 38(3), 793-801.
- Recendes, T., Aime, F., Hill, A. D., & Petrenko, O. V. (2022). Bargaining your way to success: The effect of Machiavellian chief executive officers on firm costs. *Strategic Management Journal*, 43(10), 2012-2041.
- Rhodewalt, F., & Morf, C. C. (1998). On self-aggrandizement and anger: A temporal analysis of narcissism and affective reactions to success and failure. *Journal of Personality and Social Psychology*, 74(3), 672.
- Robins, R. W., & John, O. P. (1997). Effects of visual perspective and narcissism on self-perception: Is seeing believing? *Psychological Science*, 8(1), 37-42.
- Sitthipongpanich, T., & Polsiri, P. (2015). Do CEO and board characteristics matter? A study of Thai family firms. *Journal of Family Business Strategy*, 6(2), 119-129.
- Smith, W. K., & Tushman, M. L. (2005). Managing strategic contradictions: A top management model for managing innovation streams. *Organization Science*, 16(5), 522-536.
- Waldman, D. A., & Peterson, S. J. (2018). Do humble CEOs matter? An examination of CEO humility and firm outcomes. *Journal of Management*, 44(3), 1147-1173.
- Wales, W. J., Patel, P. C., & Lumpkin, G. T. (2013). In pursuit of greatness: CEO narcissism, entrepreneurial orientation, and firm performance variance. *Journal of Management Studies*, 50(6), 1041-1069.
- Wang, C., Kafourous, M., Yi, J., Hong, J., & Ganotakis, P. (2020). The role of government affiliation in explaining firm innovativeness and profitability in emerging countries: Evidence from China. *Journal of World Business*, 55(3).
- You, S., Li, Z., Jia, L., & Cai, Y. (2023). CEO narcissism and innovation ambidexterity: The moderating roles of CEO power and firm reputation. *Journal of Product Innovation Management*, 40(2): 175-194.
- Zhang, W. (2015). R&D investment and distress risk. *Journal of Empirical Finance*, 32, 94-114.
- Zhang, H., Ou, A. Y., Tsui, A. S., & Wang, H. (2017). CEO humility, narcissism and firm innovation: A paradox perspective on CEO traits. *The Leadership Quarterly*, 28(5), 585-604.
- Zhu, D. H., & Chen, G. (2015a). CEO narcissism and the impact of prior board experience on corporate strategy. *Administrative Science Quarterly*, 60(1), 31–65.
- Zhu, D. H., & Chen, G. (2015b). Narcissism, director selection, and risk-taking spending. *Strategic Management Journal*, 36(13), 2075–2098.

TABLE 1 Correlation matrix and descriptive statistics

	Mean	SD	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Innovation performance	2.459	1.805	0.000	7.014	1.000												
2 CEO Narcissism	0.116	0.175	0.000	0.746	0.120**	1.000											
3 R&D intensity	0.058	0.048	0.000	0.266	0.252**	0.094**	1.000										
4 CEO Career horizon	-17.493	47.255	-131.909	56.500	-0.120**	-0.173**	-0.099**	1.000									
5 Firm size	22.063	1.126	19.907	25.520	0.323**	0.106**	0.029*	-0.124**	1.000								
6 Firm age	2.851	0.327	1.946	3.497	-0.050**	0.042**	-0.074**	-0.044*	0.165**	1.000							
7 Firm leverage	0.385	0.193	0.053	0.883	0.132**	-0.028 †	-0.153**	0.027	0.475**	0.158**	1.000						
8 ROE	0.055	0.120	-0.678	0.305	0.143**	0.020	-0.038*	-0.074**	0.100**	-0.054**	-0.148	1.000					
											**						
9 CEO Educational background	3.433	0.824	1.000	5.000	0.086**	0.127*	0.134**	-0.035 †	0.142**	-0.052**	0.059	0.014	1.000				
											**						
10 CEO Gender	0.944	0.231	0.000	1.000	0.005	0.065*	-0.001	-0.009	0.015	-0.025	0.025	-0.005	0.001	1.000			
11 CEO Political ties	0.248	0.432	0.000	1.000	-0.029 †	0.015	-0.085**	0.016	0.152**	0.180**	0.117	-0.013	0.027	0.057	1.000		
											**		†	**			
12 CEO Overseas background	0.112	0.315	0.000	1.000	0.026	0.029 †	0.044**	0.025	-0.024	-0.074**	-0.051	0.017	0.132	0.038	-0.105	1.000	
											**		**	*	**		
13 CEO Duality	0.293	0.455	0.000	1.000	0.018	0.215**	0.138**	-0.245**	-0.097**	-0.070**	-0.067	0.046	0.024	0.032	-0.015	0.053	1.000
											**	**		*		**	

TABLE 2 Baseline results⁵

VARIABLES	(1) Patent	(2) Patent	(3) Patent	(4) Patent
CEO Narcissism	0.378** (2.698)	0.373** (2.655)	0.364** (2.593)	0.418** (2.936)
Firm size		0.065 (1.506)	0.055 (1.250)	0.064 (1.465)
Firm age		-0.010 (-0.030)	-0.039 (-0.112)	-0.038 (-0.110)
Firm leverage		-0.382* (-2.332)	-0.292 † (-1.765)	-0.321 † (-1.939)
ROE			0.508** (3.683)	0.506** (3.676)
CEO Educational background			-0.056* (-1.976)	-0.050 † (-1.725)
CEO gender			-0.133 (-1.372)	-0.092 (-0.940)
CEO Political ties				-0.056 (-1.024)
CEO Overseas background				-0.222** (-3.010)
CEO Duality				-0.114* (-2.172)
Constant	2.415** (116.013)	1.147 (0.881)	1.724 (1.320)	1.527 (1.166)
Observations	3,955	3,955	3,955	3,955
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adj_R ²	0.793	0.793	0.794	0.795
F	7.277	3.397	4.832	4.797

Note⁵ (1). **, *, and † denote significance at the 1%, 5% and 10% levels, respectively. (2). The t test value is in the parentheses. (3).

Observations is the sample observation value. (4). Adj_R2 is the adjusted model fit. Degree. (5). F is the F test value. The same below.

TABLE 3 The mediating role of R&D intensity

VARIABLES	(1) Patent	(2) R&D intensity	(3) Patent
R&D intensity			2.974** (5.444)
CEO narcissism	0.418** (2.936)	0.011* (2.385)	0.386** (2.722)
Firm size	0.064 (1.465)	0.003* (2.141)	0.055 (1.270)
Firm age	-0.038 (-0.110)	-0.019 † (-1.726)	0.018 (0.051)
Firm leverage	-0.321 † (-1.939)	-0.025** (-4.858)	-0.246 (-1.487)
ROE	0.506** (3.676)	-0.037** (-8.561)	0.616** (4.446)
CEO Educational background	-0.050 † (-1.725)	0.003** (2.839)	-0.057** (-1.996)
CEO gender	-0.092 (-0.940)	-0.002 (-0.674)	-0.086 (-0.881)
CEO Political tie	-0.056 (-1.024)	-0.005** (-2.871)	-0.041 (-0.758)
CEO Overseas background	-0.222** (-3.010)	0.002 (1.052)	-0.230** (-3.121)
CEO Duality	-0.114* (-2.172)	-0.000 (-0.150)	-0.114* (-2.167)
Constant	1.527 (1.166)	0.051 (1.236)	1.376 (1.055)
Observations	3,955	3,955	3,955
R-squared	0.825	0.751	0.827
Firm FE	YES	YES	YES
Year FE	YES	YES	YES
Adj_R ²	0.795	0.708	0.797
F	4.797	11.72	7.092

TABLE 4 The Bootstrap test

	Coef.Estimate	Std.Err.	P> z	95% confidence interval	
Indirector effect	0.083552	0.038740	0.031000	0.007622	0.159482
Director effect	0.764189	0.153137	0.000000	0.464046	1.064332

TABLE 5 The moderating role of CEO career horizon

VARIABLES	(1) R&D intensity	(2) R&D intensity	(3) Patent	(4) Patent
CEONarcissism×CEOcareer	0.00014* (2.215)	0.00013* (2.167)		
CEO Narcissism	0.009 † (1.946)	0.008 † (1.821)		
R&D intensity×CEOcareer			-0.035** (-3.231)	-0.035** (-3.258)
R&D intensity			2.712** (3.625)	3.073** (4.048)
CEOcareer	0.000** (2.581)	0.000* (2.121)	-0.001* (-2.496)	-0.002** (-3.245)
Firm Size		0.004** (2.998)		-0.107* (-2.008)
Firm Age		-0.021 † (-1.848)		-1.197** (-2.803)
Firm Leverage		-0.027** (-5.277)		-0.208 (-1.083)
ROE		-0.033** (-7.758)		0.570** (3.542)
CEO Educational background		0.001 (1.139)		-0.089** (-2.611)
CEO Gender		-0.000 (-0.091)		-0.055 (-0.516)
CEO Political ties		-0.007** (-3.990)		-0.073 (-1.160)
CEO Overseas background		0.004 (1.608)		-0.175 † (-1.906)
CEO Duality		0.002 (1.224)		-0.157* (-2.536)
Constant	0.051** (72.299)	0.027 (0.598)	2.175** (50.628)	8.428** (5.061)
Observations	2,795	2,795	2,795	2,795
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adj_R ²	0.705	0.717	0.798	0.801
F	5.057	10.56	9.012	6.498

TABLE 6 Robustness checks

	(1) The number of patent authorizations	(2) CEO Signature	(3) Control CEO overconfidence
VARIABLES	Patent1	Patent	Patent
CEO narcissism	0.273* (2.286)		0.408** (2.865)
CEO Signature		0.031** (3.764)	
Firm size	0.086* (2.322)	0.071 (1.627)	0.063 (1.435)
Firm age	-0.331 (-1.143)	0.095 (0.274)	-0.021 (-0.062)
Firm leverage	-0.123 (-0.886)	-0.319 † (-1.931)	-0.332* (-1.999)
ROE	0.018 (0.152)	0.497** (3.614)	0.506** (3.662)
CEO Educational background	0.006 (0.250)	-0.045 (-1.558)	-0.048 † (-1.683)
CEO gender	0.001 (0.014)	-0.101 (-1.033)	-0.096 (-0.983)
CEO Political tie	-0.091* (-1.975)	-0.060 (-1.102)	-0.054 (-0.990)
CEO Overseas background	-0.170** (-2.736)	-0.225** (-3.040)	-0.224** (-3.025)
CEO Duality	-0.045 (-1.010)	-0.135* (-2.537)	-0.116* (-2.204)
CEO overconfidence			-0.162 (-1.189)
Constant	1.327 (1.206)	0.903 (0.686)	1.607 (1.216)
Observations	3,955	3,955	3,943
Firm FE	YES	YES	YES
Year FE	YES	YES	YES
Adj_R ²	0.825	0.795	0.795
F	2.273	5.359	4.529

TABLE 7 High-dimensional fixed effects

VARIABLES	(1) Patent	(2) Patent	(3) Patent
CEO Narcissism	0.799** (3.954)	0.865** (4.195)	0.790** (3.224)
Firm Size	0.161** (2.888)	0.135* (2.328)	0.162* (2.419)
Firm Age	-0.472 (-1.121)	-0.119 (-0.271)	-0.501 (-0.980)
Firm Leverage	-0.295 (-1.525)	-0.344 † (-1.707)	-0.325 (-1.392)
ROE	0.370* (2.458)	0.372* (2.405)	0.226 (1.220)
CEO educational background	-0.082 (-1.555)	-0.107 † (-1.940)	-0.145* (-2.103)
CEO Political ties	-0.081 (-0.902)	-0.105 (-1.138)	-0.077 (-0.695)
CEO Overseas background	-0.126 (-0.808)	-0.167 (-1.043)	-0.284 (-1.578)
CEO Duality	-0.260* (-2.244)	-0.279* (-2.372)	-0.230 (-1.638)
Constant	0.652 (0.396)	0.347 (0.202)	1.009 (0.514)
Observations	3,692	3,685	3,292
Firm FE	YES	YES	YES
Year FE	YES	YES	YES
CEO FE	YES	YES	YES
Province-Year FE		YES	YES
City-Year FE			YES
Adj_R ²	0.825	0.828	0.820
F	5.049	5.126	3.523

TABLE 8 Mitigating endogeneity.

	(1)	(2)	(3)
	First stage	Second stage	Heckman
VARIABLES	Narcissism	Patent	Patent
Narcissism		0.751** (2.707)	0.444* (2.278)
IV	0.984** (34.709)		
Firm size	0.010** (2.128)	0.059 (1.342)	0.094 (1.165)
Firm age	0.013 (0.366)	-0.029 (-0.084)	0.767 (1.453)
Firm Leverage	0.035* (2.041)	-0.326* (-1.968)	0.093 (0.328)
ROE	0.014 (0.978)	0.497** (3.603)	0.512** (2.666)
CEO Educational background	0.001 (0.190)	-0.050 † (-1.723)	0.004 (0.074)
CEO Gender	0.020* (1.997)	-0.097 (-0.992)	-0.509** (-2.821)
CEO Political tie	-0.009 (-1.628)	-0.056 (-1.025)	-0.246** (-2.865)
CEO Overseas background	-0.001 (-0.138)	-0.222** (-3.006)	-0.071 (-0.657)
CEO Duality	0.055** (10.195)	-0.137* (-2.481)	-0.077 (-0.840)
Imr			-0.187 (-1.406)
Constant	-0.298* (-2.193)	1.559 (1.242)	-0.955 (-0.414)
Observations	3,955	3,955	1,894
Firm FE	YES	YES	YES
Year FE	YES	YES	YES
Adj_R ²	0.764	-	0.838
F	138.9	-	3.677
	(1)	(2)	(3)