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ORIGINAL PAPER

CEO Hubris and Firm Pollution: State and Market Contingencies in a Transitional Economy

Lu Zhang[1] · Shenggang Ren[1] · Xiaohong Chen[1,2] · Dayuan Li[1] · Duanjinyu Yin[3]

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Abstract
This study focuses on CEO hubris and its effect on corporate unethical behaviour—pollution in particular, and in addition examines critical institutional contingencies [state ownership (SO), political connection (PC) and industrial competition] which may moderate this effect. With data from over-polluting listed firms based on the real-time pollution monitoring system in transitional China from 2015 to 2017, we find that CEO hubris is significantly positively related to firm pollution, and that the moderating role of SO is not significant, that PC positively moderates the hubris–pollution relationship and that industrial competition negatively moderates this relationship. These findings contribute to research on the upper echelon theory, institutional theory and the growing literature on emerging economies.

Keywords CEO hubris · Firm pollution · State ownership · Political connection · Industrial competition · China

Introduction

Over the last few decades, there have been mounting concerns about environmental deterioration worldwide (Darnall et al. 2010; Kock et al. 2012; Xu et al. 2016). Firms are important pollution contributors and their unethical behaviours have been increasingly in the public eye, such as BP's oil spill in the Gulf of Mexico, Volkswagen's emissions scandal and Mitsubishi Motors' decades-long cheating on fuel tests (Bowen et al. 2018; Meng et al. 2013; Zeng et al. 2010).

Why do firms engage in unethical behaviours of polluting rather than environmentally responsible activities? This question has roused strong interest among scholars in the environmental management field (Madsen 2009; Zeng et al. 2012; Zou et al. 2015). This body of research suggests that heterogeneous environmental actions depend on various aspects, including managerial structures (Walls et al. 2012), research and development expenditure (Berrone et al. 2013) and stakeholder engagement (Herremans et al. 2016). While there is a growing body of literature exploring the contextual and organisational factors that have impact on companies' environmental actions, little work has been done to examine the role of CEOs (Walls and Berrone 2017). The upper echelon theory (UET) posits that corporate strategic decisions, including social and environmental policies (Arena et al. 2017; Tang et al. 2015), are significantly influenced by top managers (CEOs, in particular). The UET suggests that a leader's cognitive biases and personal values serve as filters when analysing complicated situations and thus influence their strategic choices and corporate outcomes (Hambrick and Mason 1984).

As top managers, CEOs strongly influence how environmental issues should be addressed (Sharma 2000; Walls et al. 2012). Recent research finds that managers play a critical role in explaining the diversity of corporate

✉ Dayuan Li
bigolee@163.com

Lu Zhang
luzhang@csu.edu.cn

Shenggang Ren
735850292@qq.com

Xiaohong Chen
csu_cxh@163.com

Duanjinyu Yin
d.yin@qmul.ac.uk

[1] Collaborative Innovation Center of Resource-Conserving & Environment-Friendly Society and Ecological Civilization, School of Business, Central South University, Changsha, China

[2] Hunan University of Commerce, Changsha, China

[3] School of Business and Management, Queen Mary University of London, London, UK

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environmental practices (Lewis et al. 2014; Zhang 2017). For example, Rego et al. (2017) suggest that the characteristics of top executives are an important factor of corporate sustainability. Walls and Berrone (2017) find that CEOs with informal power and with a background in environmental expertise spur firms toward greener strategies.

In spite of these fruitful research results, the relationship between characteristics of CEOs and corporate environmental actions remains relatively underdeveloped (Lewis et al. 2014). Hambrick (2007) proposed that the demographic characteristics of CEOs, such as age, tenure and educational background, could be used as indicators of their personal values. In addition to these observable factors, scholars are also starting to investigate underlying psychological characteristics which have crucial impacts on CEOs' decision-making processes (Rijsenbilt and Commandeur 2013; Wu et al. 2015). One of these key psychological characteristics is CEO hubris (Fabrizi et al. 2014), which deeply influences a wide range of corporate strategies (Tang et al. 2015), such as corporate investment strategies (Malmendier and Tate 2008), earnings management (Hribar and Yang 2015), corporate acquisitions (Brown and Sarma 2007), firm risk taking (Li and Tang 2010) and corporate social responsibility (Tang et al. 2015). Nevertheless, to the best of our knowledge, the stream of literature on CEO hubris has seldom been extended to the ecological context (Tang et al. 2015). The notable exception to this is Arena et al. (2017), who explored the effect of CEO hubris on environmental innovation. Given the significant adverse effects of corporate environmental misconduct on the interests society as a whole (Chen et al. 2015; Flammer 2013), it is imperative to understand what triggers a company to engage in environmental misconduct. Following the line of study (Fabrizi et al. 2014; Wong et al. 2011), this research explores the link between CEO hubris and firm pollution. Specifically, we focus on Chinese enterprises that excessively discharge waste gas and water, and examine if CEO hubris leads to more frequent pollution behaviours.

Furthermore, this paper investigates three institutional factors that may weaken or strengthen the hubris–pollution relationship. While the majority of this work has focused on internal CEO power, governance mechanisms (Cormier et al. 2016; Park et al. 2018) or organisational slack (Arena et al. 2017), we have a limited understanding of how such a relationship might be influenced by external institutional contexts (Tang et al. 2015). In fact, according to institutional theory (DiMaggio and Powell 1991), firms are embedded in different institutional environments and institutional pressure is an important driver for corporate environmental behaviours (Li et al. 2018). In transitional economies, firms face both a dominant state logic and an emerging market logic (Yiu et al. 2014), so we explore the moderating role of the two institutional logics. Considering that this study is done in the context of transitional China, we use state ownership (SO) and political connection (PC) to represent state logic and industrial competition to represent market logic.

China is a state-dominated country with severe environmental problems, and is transitioning to a market-oriented economy. Therefore, it is of great significance to explore the moderating effect of both the state logic and the market logic in the hubris–pollution relationship. We propose that firms with hubristic CEOs are less likely to engage in environmental misconduct when there is a high level of SO and when they face fierce industrial competition, and are more likely to be environmentally irresponsible when they are politically connected.

This study has several theoretical implications for UET, institutional theory and the growing literature on emerging economies. First, we extend CEO hubris research to the ecological context, as previous research mainly focuses on the economic outcomes of CEO hubris; this aspect of the study contributes to the UET. We find that CEO hubris does matter in determining a firm's propensity to engage in polluting behaviours. Second, this study also contributes to institutional theory. We explored the different moderating effects of two institutional logics, i.e. the state logic and the market logic, on the hubris–pollution relationship, since they are both prominent in transitional China, which will reveal aspects of the institutional conditions of the relationship between CEO hubris and firm pollution. Third, this study also contributes to the growing literature on emerging economies. This research focuses on China, a country with both excessive environmental pollution in industry and weak institutions (Meyer et al. 2009; Wei et al. 2017). On the one hand, China is facing serious threat of environmental pollution along with its rapid economic growth (Li et al. 2018); on the other hand, China's transition from a planned economy into a market-based economy is happening under the conditions of underdeveloped legal systems, inefficient legal implementation and the absence of supporting institutions (Meyer et al. 2009). Thus, China provides a useful and institutional context in which to extend this line of research. The findings will thus be of value for other emerging economies in preventing corporate environmental misconduct, as these countries are also faced with severe pollution and the lack of sound regulations and institutions (Peng et al. 2015).

In summary, this study explores the impact of CEO hubris on firm pollution, and the moderating effects of institutional logics (SO and PC of state logic, and industrial competition of market logic) on this relationship in the Chinese context. Figure 1 illustrates the framework and conceptual linkages among focal variables of this study.

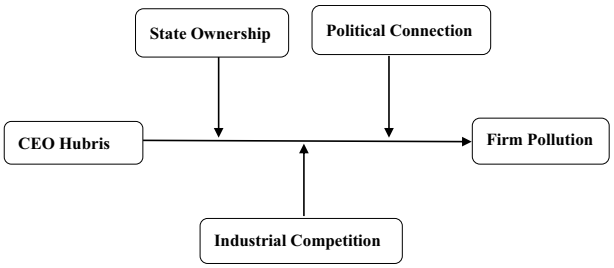

Fig. 1 Research framework

Theoretical Background

Corporate Executives and Firm Environmental Behaviour

The UET proposes that top managers' characteristics significantly affect a firm's decisions (Hambrick and Mason 1984). Similarly, top managers are one of the most influential factors in determining firms' environmental initiatives (Sharma 2000). Therefore, the extent of firms' environmental investments depends heavily on CEOs' attitudes toward environmental issues (Aragón-Correa 1998), and such attitudes have a lot to do with CEOs' personality characteristics.

As CEO personality characteristics are latent variables, demographic characters, e.g. age, race, gender, education (Johnson et al. 2012) are frequently employed as proxies. For instance, Meng et al. (2013) provide evidence for how these CEO characteristics predict firms' environmental performance; Lewis et al. (2014) examined the effects of CEO educational background (legal degree or MBA) on corporate environmental information disclosure; Gröschl et al. (2017) examined the co-evolution of leaders' cognitive ability and corporate sustainability, Ortiz-de-Mandojana et al. (2018) examined how CEOs' time perspective affects corporate investments in environmentally responsible technologies; Yang et al. (2018) explored how managerial cognition of institutional pressures relates to managers' focus on proactive environmental strategy.

Since managers devise strategies based on their cognitions and perceptions (Yang et al. 2018), it is critical to understand how their cognitions and cognitive biases lead to actual environmental behaviours. However, there has seldom been any scholar focusing on the issue of whether the cognitive bias of CEOs plays a role in firms' engagement in corporate environmental activities. To the best of our knowledge, only Arena et al. (2017) have explored the effect of CEO hubris on corporate environmental innovation. As CEOs' environmental decision-making process often depends on more complex mental activity (Hiller and Hambrick 2005), we decided to focus on CEO hubris, a particular psychological orientation of executives (Tang et al. 2015).

CEO Hubris

Hubris, a notion originating from Greek mythology, is one's exaggerated self-confidence or pride (Park et al. 2018; Hayward and Hambrick 1997). Roll (1986) first incorporated it into the management literature in his investigation of why CEOs make value-destructive acquisitions. Hubris is distinguished from related psychological concepts such as self-esteem, or narcissism (Hiller and Hambrick 2005; Park et al. 2018; Tang et al. 2018). Self-esteem, although aligned with hubris in terms of the aspect of self-admiration, lacks the core features of a sense of entitlement or arrogance (Chatterjee and Hambrick 2007). Narcissistic CEOs always need constant applause and attention and look for reaffirmation of their superiority from others, while hubristic CEOs exhibit a significantly reduced need for stakeholder support (Tang et al. 2018).

CEO hubris manifests itself in relations with the self, relations with others and relations with the world (Petit and Bollaert 2012; Cormier et al. 2016). Accordingly, hubristic CEOs have three distinguishing characteristics. First, they tend to overestimate their abilities and have the illusion of control and exaggerate their power to handle intractable situations (Brown and Sarma 2007). It is often the case that they overestimate their knowledge and ability and at the same time underestimate the risk of sudden incidents (Malmendier and Tate 2008). Moreover, hubristic CEOs tend to consider themselves uniquely qualified to operate the firm and are likely to adopt entrenchment strategies to protect their positions (Park et al. 2018; Petit and Bollaert 2012; Shleifer and Vishny 1989). Second, hubristic CEOs consider themselves above the community of humans and have self-attribution bias; they are apt to attribute success to their own abilities and consider failure or poor performance as the influence of external factors (Gervais et al. 2007). Third, hubristic CEOs are more optimistic about the investment environment. They tend to hold the belief that unexpected events have limited adverse effects on their firms, and take for granted that the probability of success of their projects is higher than that of the projects of their counterparts (Hackbarth 2008).

Existing literature on the consequences of CEO hubris, whether value-destroying (Cormier et al. 2016; Hayward and Hambrick 1997; Tang et al. 2015) or value-enhancing (Hirshleifer et al. 2012; Arena et al. 2017), mainly focuses on a business or social setting, but seldom pays attention to the ecological context. For theoretical completeness, and due to the salience of the issue, we here extend CEO hubris into an ecological setting and explore whether this quality leads to more pollution.

Hypothesis Development

CEO Hubris and Firm Pollution

Building upon Petit and Bollaert (2012) and Park et al.'s (2018) models, we argue that a more complete understanding of firm pollution can be gained by adopting a comprehensive framework encompassing CEO hubris. We expect that a CEO's hubris manifests itself through their relations with themselves, with others and with the world (Petit and Bollaert 2012), and tends to become entrenched and unethical (Cormier et al. 2016; Park et al. 2018), especially in the case of pollution.

In their relations with themselves, hubristic CEOs tend to have a grandiose sense of self and make excessive investments for their own 'self' (Park et al. 2018; Petit and Bollaert 2012). Hubristic CEOs lean too heavily on their own judgment and overestimate the probability of their firm's success (Hilary and Menzly 2006). Due to their excessive optimism and lack of prudent consideration, hubristic CEOs are more likely to underestimate the risks faced by the firms and to think that adverse events have limited influence on them (Hiller and Hambrick 2005). Therefore, they have a diminished awareness of the serious damage of environmental misconduct (Mishina et al. 2010). Also, hubristic CEOs tend to become entrenched and engage in investments that make them valuable to shareholders rather than other alternatives (Shleifer and Vishny 1989; Park et al. 2018). Hubristic managers know that they are at risk of being replaced for suboptimal financial performance (Walsh and Seward 1990), so they may overinvest in manager-specific 'pet projects' while underinvesting in projects such as environmental improvement which benefit the whole company and society in the long-run (Park et al. 2018).

As for relations with others, hubristic CEOs tend to consider themselves above the general community of humans (Petit and Bollaert 2012). They may exhibit contempt for the advice or criticism of others in improving environmental performance. They tend to be immune to environmental pressures posed by internal and external governance mechanisms such as directors, investors, auditors, analysts and regulators (Cormier et al. 2016). Hubristic CEOs are likely to have a sense of self-sufficiency, to think that their firms possess enough internal resources (Malmendier and Tate 2008) and to underestimate the pressure from stakeholders (Hiller and Hambrick 2005). Such CEOs believe in their ability to manage risks without external assistance (Tang et al. 2015). Consequently, they are less likely to build up a reservoir of environmental reputation, as their perceived need for positive publicity by engaging in environmentally responsible practices is low. As Tang et al. (2015) demonstrated, hubristic CEOs are less motivated to respond to stakeholder demands, and as a consequence, they engage in less corporate social responsibility. For instance, under the leadership of Martin Winterkorn, who is tall, gruff and stern, and who was ranked 58th out of the world's most powerful people by Forbes (2014), Volkswagen aggressively set the lofty goal of becoming the number one car company in the world. Although the company achieved the position of the world's best-selling automaker in the first half of 2015, its sales crashed after the notorious emissions testing scandal late that year. Ironically, in 2014, Winterkorn urged 'European regulators not to overburden the automotive industry with excessive emission targets, citing a lack of time to develop fuel-efficient technology and the economic downturn as major concerns' (Forbes 2014).

In their relationships with the world, hubristic CEOs consider themselves above the laws or the natural order, and thus may exhibit contempt toward authorities and engage in fraud and the manipulation of rules and laws (Petit and Bollaert 2012). Hubristic CEOs tend to set lofty goals and adopt aggressive strategies to achieve them (Fairbank et al. 2006). When enormous gaps between reality and the target emerge, radical changes will be triggered (Labianca et al. 2009). Agnew et al. (2009) noted that when top managers fail to achieve their business objectives by legal means, they might begin to employ unethical means. For example, CEO Bernard Ebbers boasted that his goal was to make his company Enron the number one performing stock on Wall Street. To maintain the high stock price, Enron committed notorious accounting scandals (Veasey 2003). Under the adventurous leader Jinghe Chen, Zijin Mining grew up from a small state-owned enterprise (SOE) into the largest gold producer in China. However, it was accused of conducting operations that caused toxic water to leak into a local river in July 2010, causing severe pollution. The company did not report the spill until 9 days after the leakage. Moreover, it was accused of bribing journalists not to report the spill (Hu et al. 2010).

Thus, it is has been extensively theorised that hubris causes CEOs to disregard laws, regulations and moral imperatives and give themselves their own unique mandate to achieve their business goals. Such behaviour can easily lead them to ignore or overlook environmental damage in the pursuit of their own projects. Accordingly, we propose:

Hypothesis 1 CEO hubris is positively related to firm pollution.

State and Market Contingencies in Transitional China

If CEO hubris leads to more pollution, then what factors can mitigate or exacerbate this unethical behaviour? In

our context, the effects of CEO hubris on the amount of environmental violations a firm commits depend deeply on institutional pressures such as governmental intervention and market competition. So we investigate state and market contingencies from an institutional perspective rather than exploring corporate governance contingencies (Park et al. 2018). Institutional theory characterises firms as dependent on contingencies in the institutional environment (DiMaggio and Powell 1991). Institutional logic defines the norms, values and beliefs that provide rationales for the cognition and action of executives in organisations (DiMaggio and Powell 1991; Greve and Zhang 2017). Two institutional logics are considered pertinent to the running of businesses in a transitional economy such as China: state logic and market logic (Greve and Zhang 2017; Li et al. 2018). Considering SO and PC to be good proxies for state logic (Maung et al. 2016) and industrial competition as a good proxy for market logic, we explore the moderating effects of these logics on CEO hubris accordingly.

Moderating Effects of State Ownership

As China is a traditional planned economy, the government can exert huge influence on corporations directly through ownership of shares in firms (Zhou et al. 2017). SO affects the likelihood of CEO hubris having an effect on firm pollution in several ways.

First, firms with higher levels of SO have more resources and power, which allows hubristic CEOs to take more environmentally responsible initiatives. Since environmental investment is often regarded as a burden rather than a benefit, firms generally are reluctant to engage in environmental activities (De Villiers et al. 2011). They require incentives given by the visible hand of the government, and such incentives are especially applied to state-owned firms. In transitional economies such as China, the government has firm control over scarce resources (Guo et al. 2016). SO can serve as a distinctive non-market resource, leading to financial and human resources and policy support (Zhou et al. 2017). Specifically, studies show that higher-level SO helps firms to obtain more subsidies, borrow more money at a lower cost and have better access to government-supported initiatives, which helps hubristic CEOs to engage in environmental-friendly activities (He et al. 2016), though may sometimes do so at higher cost (Darnall and Edwards 2006).

Second, firms with higher levels of SO are under greater pressure for hubristic CEOs to reduce firm pollution in order to achieve the government's goals. Unlike their private counterparts, who have maximising economic profits as a main goal, SOEs have broader political and social objectives (Li and Tang 2010), among which environmental responsibility is increasingly important. China has become the largest and fastest-growing developing country in the world, but this rapid economic growth has been at the cost of ecological deterioration (Li et al. 2017). The government has become aware of this severe issue and Premier Li Keqiang declared a 'war against pollution' in 2014. At the beginning of 2015, China began the implementation of 'the most rigorous' new Environmental Protection Law. So SOEs are always the pioneers for the government's visions and missions. Thus, to be aligned with the government's objectives, CEOs of SOEs may face more constraints in their environmental decision-making and enjoy less discretion, and hubristic CEOs would tend to comply rather than break the environmental laws and regulations, which reduces corporate unethical behaviours.

In sum, SO enables CEOs with resources as well as applies pressures and constraints to their behaviour, which in turn reduces the likelihood that hubristic CEOs will engage in polluting activities. Therefore, we propose:

Hypothesis 2 SO weakens the positive relationship between CEO hubris and firm pollution in China.

Moderating Effects of Political Connection

PC is an important means of government control and intervention in firms (Zhang 2017). To be well connected to the government is important for firms operating in countries with weak institutions, and is particularly essential for firms in China, since the government retains a strong influence on the economy (Xin and Pearce 1996). The resource-based view regards PC as a valuable resource (Barney 1991), and scholars document that politically connected managers can help their firms to obtain key resources and support from the government (Wu et al. 2012). From this perspective, PCs help firms to relax the financial constraints on environmental investments and share the risks of environmental innovation with the government: this encourages hubristic CEOs to adopt environmentally friendly practices and reduce polluting behaviours (Zhang 2017).

However, unlike SO which enables firms with resources as well as exerting controls and pressures, PC tends to induce firms to seek resources and reduce pressures from the government. For example, Zhang et al. (2016) find that firms would use their ascribed PCs as a buffer from governmental pressure.

PC may act as an umbrella of protection that helps firms to escape punishment for pollution. Since the promotion of local government officials is largely carried out on the basis of regional economic development in China, this provides a major incentive for them to value economic growth rather than environmental protection. Local government officials can also enjoy higher levels of GDP in their region as well as bribes from politically connected polluting producers. With this understanding, hubristic CEOs may take the risk of bribing local government officials through their PCs to

form a strong interest group and get away with environmental regulation and penalties for their pollution (Zhang 2017). For example, the managers of Zijin Mining Group developed strong connections with local government officials, which exacerbated the hubristic CEO's ignorance of environmental issues and caused the notorious Zijin Mining's pollution event in 2010 (Li et al. 2017).

By contrast, when organisations have limited PCs, hubristic CEOs will be forced to reconsider the support of the institutional environment for their firm, and they would have less assurance that problems that might arise due to their environmental misconduct could be solved by lobbying or bribing government officials. Consequently, these CEOs might suppress their hubristic ideas and decrease their engagement in firm pollution. Thus, we propose:

Hypothesis 3 PC strengthens the positive relationship between CEO hubris and firm pollution in China.

Moderating Effect of Industrial Competition

Though in coexistence with state logic, market logic in transitional economies is becoming increasingly prominent. An important manifestation of market logic is industrial competition: the degree to which one firm influences the survival of others in an industry (Barnett 1997). When operating in a fiercely competitive industry, firms often find themselves facing more complexity (Hambrick and Finkelstein 1987), and the availability of scarce resources reduces further, forcing hubristic CEOs to depend more on stakeholders' inputs of resources. Higher competition in an industry brings about changes and volatility and increases the uncertainty of firms' predictions, which in turn suppresses hubristic CEOs' inclination to overrate their capability for problem-solving and causes them to be more cautious, and thus weakens the hubris–pollution relationship (Tang et al. 2015). Environmentally responsible firms can obtain legitimacy and reputation from customers and regulators, which is vital in market competition (Lewis et al. 2014). Likewise, in such a fierce competing context, hubristic CEOs will reduce firm pollution in order not to lose their stakeholders' support. For example, in a competitive industry, a firm has to avoid environmental misconduct, or such conduct may be disclosed and its seriousness magnified by its competitors and the media, which will cause unpredictable losses both in reputation and profit (Koh et al. 2014; Lee et al. 2016; Tang and Tang 2016).

By contrast, in a less competitive industry where a well-established system of rules and norms of interaction prevails (Tang et al. 2015), hubristic CEOs' perception that they can handily deal with tough issues and that their firm can thrive without resource inputs from stakeholders will be further strengthened. Accordingly, we propose:

Hypothesis 4 Industrial competition weakens the positive relationship between CEO hubris and firm pollution in China.

Methodology

Sample and Data Sources

Empirical studies on corporate environmental actions are constrained by data availability (Clarkson et al. 2011). Most previous research rely on the TRI (Toxic Release Inventory) database, the KLD (Kinder, Lydenberg, Domini Research and Analytics) rating, the DJSI (Dow Jones Sustainability Index) or the CEP's (Council on Economic Priorities) environmental performance ranking (Clarkson et al. 2008; Dawkins and Fraas 2011; Searcy and Elkhawas 2012). These indexes only includes firms in developed countries, while there is no relevant database in China. Therefore, a key issue of this study is to measure firm pollution in the Chinese setting.

To the best of our knowledge, the Pollution List is the first relatively authoritative and thorough blacklist addressing firm pollution issues of Chinese-listed firms. It is compiled by an independent NGO, the Institute of Public and Environmental Affairs (IPE)[1] based on the real-time monitoring of pollution sources, and is published by the *Securities Times*, the national top one specialised financial securities daily newspaper designated by the China Securities Regulatory Commission (CSRC) to disclose the information of listed firms.

The Pollution List has been monitoring core enterprises in heavy pollutant industries since 2015. By the real-time monitoring of pollution sources, the list accurately summarises the pollution emissions data of these enterprises to see whether they are exceeded. In 2015, the list announced the top 20 excessive polluting firms ranked according to their pollution index on a weekly basis (detailed in the next section). Since September 2016, the Pollution List has announced the top 10 excessively polluting firms semi-monthly. The initial sample has 336 firm-year observations from 2015 to 2017.[2]

As the study controls for financial variables, following Du et al. (2014) we eliminated five special treatment (ST)

[1] IPE is a non-profit environmental research organisation registered in 2006 in China which is dedicated to collecting, collating and analysing government and corporate environmental information to build a database of environmental information. Its data have been used by several recent studies, such as Marquis and Bird (2018) and Zhou and Yin (2018).

[2] All the Pollution Lists can be downloaded from http://www.ipe.org.cn.

observations to avoid the influence of abnormal financial data, since ST firms are firms that have suffered losses for two consecutive fiscal years and are at the risk of being delisted, and their stock prices vary greatly. Observations of companies that had been listed in the Chinese stock market for less than 3 years (12 observations) were also excluded because these firms cannot provide information for our research. As a result, 17 observations were excluded in total, resulting in a final sample of 319 observations, corresponding to 236 firms.[3] As shown in Table 1, the sampled firms are distributed into 43 industries, with the manufacture of raw chemical materials and chemical products, the production and supply of electric power and heat power, manufacture of non-metallic mineral products, the smelting and pressing of ferrous metals, the manufacture of paper and paper products and the smelting and pressing of non-ferrous metals accounting for nearly half of the sampled firms.

Dependent Variable: Firm Pollution

The measurement of firm pollution is the frequency at which firms appear on the Pollution List. Firms on the List were the most polluting ones measured by the "pollution index", compiled by the IPE, an environmental NGO. The 'pollution index' considers the frequency and severity of a firm's pollution discharges above the regulatory standard. The detailed calculation of the Index is shown in Appendix. The more times a firm appears on the list indicates the frequency at which firm engages in polluting behaviours. From 2015 to 2017, a total of 85 editions of the list were published, and Jisco Group HongXing Iron and Steel Co., Ltd. (600,307. SH) was the most frequently listed (46 times). We log-transformed the value of firm pollution to make the sampled data more stable, which helped to bring the skewed variable to normality and reduce the collinearity and heteroscedasticity problems of the models (Walker and Wan 2012). Besides, log-transforming treatment does not change the nature of or the correlations between the data.

Independent Variable: CEO Hubris

One of the key issues in this study is to operationalise CEO hubris. It is challenging to conduct research on the psychological orientation of CEOs because CEOs are generally reluctant to show their personality traits in surveys and because any responses are likely to be influenced by social desirability concerns (Tourangeau and Yan 2007). This is probably the reason why empirical studies of CEO hubris are rare even decades after the publication of Roll's (1986) research on executive hubris. Since the end of last century, some researchers have carried out innovative explorations and put forward some practical alternative approaches to measuring CEO hubris. These studies mainly employ unobtrusive indicators, and there are several methods frequently adopted to measure CEO hubris: (1) the media-based measure, which uses data collected from business press coverage (Hribar and Yang 2015; Tang et al. 2015), (2) behavioural reflective measures based on executives' actions, such as a CEO's net purchases of the firm's own stock or option-holding behaviour (Campbell et al. 2011; Hirshleifer et al. 2012), (3) the deviation of a firm's forecast earnings and its actual earnings (Li and Tang 2010; Jiang et al. 2011), (4) the frequency of mergers and acquisitions (Doukas and Petmezas 2007), (5) the CEO's relative compensation compared to other top managers (Hayward and Hambrick 1997; Jiang et al. 2011), (6) the tone of CEO tweets (Lee et al. 2017).

In China, due to the restrictions of the stock options system, there are only a few firms implementing stock option incentives for CEOs. Also, most of the sample firms' actual earnings are the same as forecasted. Acquisitions in China are frequently made by SOEs as non-market strategies. Twitter is not accessible in China, and the Chinese social media program Weibo serves as an alternative. However, CEOs seldom write any posts on Weibo. The more popular social media in China is WeChat, an instant messaging tool launched by Tencent in 2011, with nearly one billion active users. However, it is private and an individual's posts are not accessible if one is not added to their friend list.

Therefore, we follow Malmendier and Tate (2008) and Tang et al. (2015, 2018) and adopt the media-based evaluation method to measure CEO hubris and a salary-based evaluation method as a robustness test. These measures directly capture characterisations of executive personality features (Malmendier and Tate 2008). Given the fact that our theme mainly deals with the interrelations between CEOs and external stakeholders, a media-based reflective measure that captures external audiences' perceptions of the level of a CEO's hubris would be more appropriate (Tang et al. 2018). However, we have to admit that though media reports and relative salaries reflect the underlying characteristics of CEOs to a certain extent, they are still a distal measure of the variable. We had considered corroborating our findings by analysing the content of CEO statements or speeches made by the CEO, which may be a closer measure of CEO hubris; however, we only found a few statements or speeches, which is not enough to support our empirical test.

The media-based measure applies content analysis methods to see if CEOs are hubristic by analysing their description in the media coverage (Hirshleifer et al. 2012; Hribar

[3] We tested sampling bias by comparing the observations eliminated and those that remained with regard to their characteristics (firm size, age, ROA and growth rate). The results did not reveal significant differences in firm size ($t = -1.5356$, $p > 0.10$), or age ($t = 0.534$, $p > 0.10$), or ROA ($t = 0.8467$, $p > 0.10$), or growth rate ($t = -0.5976$, $p > 0.10$). Thus, sampling bias is not a major concern for our study.

Table 1 Industry composition of sampled firms

Industry categories	Observations	Percentage (%)
Manufacture of raw chemical materials and chemical products	49	15.36
Production and supply of electric power and heat power	32	10.03
Manufacture of non-metallic mineral products	29	9.09
Smelting and pressing of ferrous metals	24	7.52
Manufacture of paper and paper products	14	4.39
Smelting and pressing of non-ferrous metals	12	3.76
Mining and washing of coal	11	3.45
Manufacture of medicines	11	3.45
Manufacture of construction product	11	3.45
Manufacture of communication equipment, computers and other electronic equipment	10	3.13
Processing of petroleum, coking and processing of nuclear fuel	10	3.13
Processing of food from agricultural products	10	3.13
Manufacture of textile	8	2.51
Manufacture of special purpose machinery	7	2.19
Petroleum and natural gas extraction industry	6	1.88
Manufacture of railway, ship, aerospace and other transport equipment	6	1.88
Real estate industry	6	1.88
Manufacture of automotive	6	1.88
Manufacture of chemical fibres	5	1.57
Manufacture of foods	4	1.25
Production and supply of water	4	1.25
Manufacture of metal products	4	1.25
Wholesale industry	4	1.25
Manufacture of liquor, beverages and refined tea	3	0.94
Production and supply of gas	3	0.94
Manufacture of general purpose machinery	3	0.94
Ecological protection and environmental management industry	3	0.94
Manufacture of rubber and plastics	2	0.63
Manufacture of textile, wearing apparel and accessories	2	0.63
Mining of non-ferrous metal ores	2	0.63
Architectural decoration and other construction industry	2	0.63
Professional and technical services industry	2	0.63
Animal husbandry	2	0.63
Printing, reproduction of recording media	2	0.63
Comprehensive	2	0.63
Other manufacture	1	0.31
Manufacture of textiles, wearing apparel, leather and footwear	1	0.31
Manufacture of education, sports and leisure	1	0.31
Processing of timber, manufacture of wood, bamboo, rattan, palm and straw products	1	0.31
Journalism and publishing	1	0.31
Manufacture and instrumentation	1	0.31
Business services	1	0.31
Retail industry	1	0.31
Total	319	100

and Yang 2015; Malmendier and Tate 2008). This media evaluation is built on the assumption that media reports can reflect the underlying characteristics of CEOs (Chen et al. 2015). We first collected news articles that mentioned each of the CEOs in our sampled firms from mainstream media including *The People's Daily, Twenty-First Century Business Herald, Southern Weekly, China Business Journal, The Economic Observer* and so on. Following prior studies

Table 2 Word groups and frequency of CEOs' press coverage

Word groups	Frequency
"Confident/confidence" mentions	226
"Optimistic/optimism" mentions	311
"Not confident" mentions	105
"Not optimistic" mentions	134
"Cautious, conservative, frugal" mentions	165

(Hirshleifer et al. 2012; Tang et al. 2015), we accumulated articles published from the first year that the CEO took office up to the year ($t-1$). For each CEO, we counted the total number of terms that implied confidence ('confidence', 'confident', 'optimism' or 'optimistic') as well as the number of terms that suggested conservatism ('not confident', 'not optimistic', 'cautious', 'frugal' or 'conservative') (Malmendier and Tate 2008; Tang et al. 2015, 2018). The frequency of each group of words is shown in Table 2. Then, we computed CEO hubris ('Hubris') by taking 'the difference between the number of confident articles and that of conservative ones for a specific CEO, divided by the sum of the two numbers' (Hribar and Yang 2015; Tang et al. 2015). As a result, CEO hubris was computed as a continuous variable ranging from − 1 to 1. The higher the value, the higher the level of CEO hubris.

Moderating Variables

State Ownership

State ownership ('SO') is measured as a dummy variable, i.e. 1 for firms that are state-owned, and 0 otherwise. Since changes in firms' ownership structures do not happen very often, this measurement is an objective and enduring indicator (Zhou et al. 2017).

Political Connection

Following Maung et al. (2016), political connection ('PC') is measured as a dummy variable: it equals 1 if the CEO served as or is serving as a member of the National People's Congress of the Communist Party of China, a government official or a member of the political consultative conferences, 0 otherwise.

Industrial Competition

Following prior empirical studies (Tang et al. 2015), in order to measure industrial competition, CR4 (i.e. the concentration ratio of the top four firms) is calculated first, which is the combined market share (based on sales) of the four largest firms divided by the total sales within each industry (Palmer and Wiseman 1999). Then, industrial competition ('Competition') is measured as 'the natural logarithm of one minus the CR4 divided by CR4 at year t − 1'. A higher value of competition indicates higher complexity and uncertainty in the industry, where firms are more likely to adopt heterogeneous strategies to compete against each other.

Control Variables

We controlled for CEO demographical, firm characteristic and corporate governance variables. CEO demographical variables include:

(1) *CEO tenure* the time a CEO spends in a position may help them accumulate knowledge and experience for environmental management and ecologically sustainable development. CEOs with longer tenure will develop more profound knowledge about socially responsible investments and internal and external stakeholder needs, so that they will be more open to social and environmental imperatives and less likely to engage in environmentally irresponsible activities (Allen 1981; Ortiz-de-Mandojana et al. 2018).
(2) *CEO gender* women CEOs tend to pursue ethical leadership, long-term and stable business growth (Ho et al. 2015). When it comes to the issue of environmental responsibility, they may also be cautious in order to enhance the legitimacy of the firm (Boden and Nucci 2000; Ho et al. 2015). This is a dummy variable: it equals 1 if the firm has a male CEO, and 0 if the CEO is female.
(3) *CEO age* research on ethics has achieved the consistent understanding that aged CEOs seem to have better performance concerning social responsibility (Daboub et al. 1995). So except CEO tenure and CEO gender, we also introduce CEO age to control the influence of CEO characteristics (Tang et al. 2015).

We also controlled for the following firm characteristic variables:

(1) *Firm age* aged firms tend to be more responsible, as they are more concerned about reputation built over the years than newly listed firms. Firm age is computed by the number of years since the firm was listed on the Shanghai/Shenzhen Stock Exchange.
(2) *Financial performance* financial performance has been shown to influence firms' engagement in environmental activities (Adams and Hardwick 1998; Walker and Wan 2012). We used three financial variables including return on assets (*ROAs*), Leverage (the ratio of total liabilities to total assets) and growth rate (prime operat-

ing revenue at year t minus prime operating revenue at year $(t-1)$)/prime operating revenue at year $(t-1)$.

(3) *Organisational slack* we employed the current assets/current liabilities ratio at year $(t-1)$ to measure slack (Bansal 2005). Firms with a higher ratio tend to have greater capability to raise additional funds via incurring debt, and thus the power to allocate resources for alternative uses is less confined (Chen et al. 2017). Since the variable is skewed, we log-transformed it so as to achieve normality (Walker and Wan 2012). A higher logged value indicates more slack in the organisation and suggests that the firm is less limited by resources.

(4) *Industry* firms in environmentally sensitive industries (industries with high energy consumption and high pollution)[4] are under stricter supervision of the government and may be more active in environmental activities so as to exhibit their legitimacy (Boesso and Kumar 2007). Industry is a dummy variable, equalling 1 when a firm belongs to an environmentally sensitive industry and 0 otherwise.

Corporate governance variables include:

(1) *Leadership structure* the chairperson of the board (COB) and CEO represent the interest of the focal company and the shareholders, respectively (Li et al. 2018). If the CEO and the COB are the same person, this is called CEO duality. When the CEO is also the COB, they have less constraints from the board and more discretion in decision-making, which could lead to poor environmental performance. For example, Webb (2004) finds that CEO duality is negatively associated with corporate social responsibility. A dummy variable, 'Duality', was introduced, 1 for CEO duality and 0 otherwise (Peng et al. 2010).

(2) *Board independence* CEOs' self-serving behaviours such as pollution could be monitored by independent outside directors (Chang et al. 2017). Prior research found that board independence has a linear or curvilinear relationship with CSR (Chang et al. 2017; Harjoto and Jo 2011), and positively affects corporate sustainability initiatives (Ben-Amar et al. 2017). We used the number of independent directors divided by the total number of directors on the board (noted as INDIR) as the independent director ratio (Li et al. 2018).

[4] Based on the heavy pollution industry defined by the Ministry of Environmental Protection of China, this paper regards the following industries as the environmentally sensitive industry, including 'Production and Supply of Electric Power and Heat Power', 'Manufacture of Textile', 'Manufacture of Non-metallic Mineral Products', 'Smelting and Pressing of Ferrous Metals', 'Manufacture of Chemical Fibres', 'Manufacture of Raw Chemical Materials and Chemical Products', 'Manufacture of Liquor, Beverages and Refined Tea, Mining and Washing of Coal, Production and Supply of Gas', 'Extraction of Petroleum and Natural Gas', 'Processing of Petroleum', 'Coking and Processing of Nuclear Fuel', 'Manufacture of Medicines, Smelting and Pressing of Non-ferrous Metals' and 'Manufacture of Paper and Paper Products'.

Results

Descriptive Statistics and Correlation Analysis

Table 3 provides the means, standard deviations and correlations for all the variables. The mean values of hubris, CEO tenure, Male CEO and CEO age are 0.141, 4.902, 0.031 and 51.13, respectively, revealing the characteristics of CEOs. Pollution frequency has a mean value of 0.644 (which is a log value), suggesting that severe problems of environmental pollution occurred in the sampled firms. The correlation coefficients among the variables are smaller than 0.5, reflecting an acceptable level of multicollinearity. Furthermore, all VIF values are lower than 3, with a maximum VIF of 2.57 (TOL = 0.389), indicating that multicollinearity among these variables is not a serious problem.

Hypothesis Testing

We tested our research hypotheses with a series of regression models. Our main findings are presented in Table 4. The dependent variable was firm pollution. Model 1 includes all the control variables. Then, we added the independent variable hubris in Model 2. Model 3 includes the independent variable, moderating variables and the control variables. Next, we added the interaction terms between hubris and the moderating variables to test the effects of SO, PC and industrial competition, the results of which are shown in Model 4. To avoid any potential multicollinearity problem, we have mean centred all the interaction terms.

As shown in Table 4, hubris is positively and significantly associated with firm pollution ($\beta = 0.220$, $t = 2.625$) in Model 2. The results suggest that firms with hubristic CEOs are associated with more frequent pollution. In terms of economic significance, the coefficient estimate of 0.220 for CEO hubris in Model 2 of Table 4 suggests that one standard deviation (0.456, see Table 3) increase in hubris above the mean will increase firm pollution by 0.10 (0.220×0.456). Taking the mean firm pollution in our sample as the benchmark (0.644, see Table 3), the magnitude of this increase is substantial, about 15.5% (0.01/0.644). These data support Hypothesis 1, which predicted that CEO hubris is positively associated with firm pollution.

As shown in Model 4 of Table 4, the interaction between hubris and SO is positive but non-significant ($\beta = 0.177$, $t = 1.195$). Thus, H2 is not supported. The interaction

Table 3 Descriptive statistics and correlations analysis

	Mean	SD	1	2	3	4	5	6	7
(1) CEO hubris	0.141	0.456	1.000						
(2) Firm pollution	0.644	0.905	0.032	1.000					
(3) Competition	0.900	0.087	−0.102*	−0.112**	1.000				
(4) Slack	−0.051	0.668	−0.012	−0.174***	0.028	1.000			
(5) Duality	0.569	0.496	−0.116**	0.448***	−0.057	−0.242***	1.000		
(6) CEO tenure	4.902	3.759	−0.039	−0.023	0.010	0.088	0.076	1.000	
(7) Male CEO	0.031	0.175	−0.012	0.007	−0.053	−0.016	0.073	−0.038	1.000
(8) CEO age	51.130	7.955	−0.039	0.114**	−0.110**	0.004	0.297***	0.300***	0.372***
(9) PC	0.098	0.298	0.035	−0.041	0.018	0.141**	−0.052	0.133**	−0.095*
(10) Firm age	13.670	5.637	0.074	−0.077	0.132**	−0.360***	−0.056	0.030	0.034
(11) ROA	0.0231	0.045	−0.003	−0.014	0.002	0.281***	0.050	−0.007	0.009
(12) Leverage	0.555	0.193	0.013	0.070	−0.026	−0.636***	−0.009	−0.037	0.073
(13) Growth rate	0.379	1.428	0.027	−0.083	0.038	−0.003	−0.106*	−0.081	0.015
(14) SO	0.260	0.439	−0.042	−0.031	−0.041	−0.213***	0.285***	−0.036	0.107*
(15) Industry	0.682	0.466	−0.082	0.266***	0.058	−0.417***	0.263***	−0.014	0.006
(16) INDIR	0.368	0.056	−0.077	0.019	0.023	0.069	−0.086	−0.001	−0.025

	8	9	10	11	12	13	14	15	16
(1) CEO hubris									
(2) Firm pollution									
(3) Competition									
(4) Slack									
(5) Duality									
(6) CEO tenure									
(7) Male CEO									
(8) CEO age	1.000								
(9) PC	0.124**	1.000							
(10) Firm age	−0.124**	−0.131**	1.000						
(11) ROA	0.074	0.083	−0.089	1.000					
(12) Leverage	0.042	−0.083	0.227***	−0.400***	1.000				
(13) Growth rate	−0.067	0.019	0.040	0.038	0.042	1.000			
(14) SO	0.014	−0.077	0.187***	−0.004	0.093*	−0.053	1.000		
(15) Industry	−0.058	−0.161***	0.236***	−0.135**	0.080	−0.009	0.129**	1.000	
(16) INDIR	0.080	−0.038	−0.035	−0.002	0.072	−0.039	−0.106*	−0.143**	1.000

*$p<0.1$; **$p<0.05$; ***$p<0.01$ (two-tailed). $N=319$

between hubris and PC is marginally significantly positive ($\beta=0.531$, $t=1.727$), suggesting that PC strengthens the focal relationship, supporting H3. The interaction between hubris and competition is marginally significantly negative ($\beta=-1.681$, $t=-1.834$), suggesting that industrial competition weakens the focal relationship. Thus, H4 is supported.

In order to better illustrate the moderating effects, this study plotted the interaction effects using one standard deviation above and below the mean to represent high and low levels of the moderating variables (Hoetker 2007; Li and Tang 2010). As shown in Fig. 2, at high levels of PCs, the hubris–pollution relationship is positive; by contrast, at low levels of PCs, the focal relationship becomes negative.

Figure 3 shows that when industrial competition is low, the hubris–pollution relationship is positive; by contrast, at high levels of competition, the focal relationship becomes negative. This is consistent with the market logic—in industries with higher levels of competition, hubristic CEOs engage in less polluting behaviours .

Robustness Tests and Endogeneity Concerns

In order to ensure the reliability of the results, a supplemental analysis was conducted. Instead of the continuous values of CEO hubris, we employed an ordered categorical variable as an alternative. Based on the continuous values

Table 4 Results of regression tests

	Dependent variable: firm pollution			
	Model 1	Model 2	Model 3	Model 4
(1) Control variables				
Slack	0.0258 (0.260)	0.0366 (0.371)	0.0293 (0.299)	−0.0205 (−0.210)
Duality	0.398*** (6.950)	0.410*** (7.133)	0.459*** (7.420)	0.468*** (7.429)
CEO tenure	−0.0103 (−0.819)	−0.00959 (−0.763)	−0.0107 (−0.880)	−0.0118 (−0.933)
Male CEO	−0.211 (−0.524)	−0.191 (−0.480)	−0.129 (−0.323)	−0.0913 (−0.263)
CEO age	−0.00178 (−0.231)	−0.00165 (−0.216)	−0.00522 (−0.666)	−0.00427 (−0.543)
Firm age	−0.0186** (−2.140)	−0.0199** (−2.285)	−0.0131 (−1.480)	−0.0103 (−1.182)
ROA	0.398 (0.345)	0.409 (0.357)	0.483 (0.432)	0.520 (0.458)
Leverage	0.489 (1.539)	0.509 (1.606)	0.526* (1.669)	0.345 (1.115)
Growth rate	−0.0266** (−2.567)	−0.0270*** (−2.593)	−0.0307** (−2.528)	−0.0268** (−2.165)
Industry	0.382*** (3.994)	0.406*** (4.236)	0.406*** (4.187)	0.356*** (3.793)
INDIR	1.043 (1.474)	1.211* (1.746)	1.056 (1.555)	1.308* (1.943)
(2) Independent variable and moderating variables				
CEO hubris		0.220*** (2.625)	0.188** (2.300)	0.0638 (0.663)
SO			−0.358*** (−2.989)	−0.384*** (−3.182)
PC			0.0213 (0.144)	−0.0499 (−0.359)
Competition			−0.895 (−1.391)	−0.873 (−1.440)
(3) Moderating effects				
CEO Hubris × SO				0.177 (1.195)
CEO hubris × PC				0.531* (1.727)
CEO hubris × competition				−1.681* (−1.834)
Adjusted R^2	0.249	0.261	0.293	0.311
F value	9.070	8.880	7.690	6.190

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$ (two-tailed). $N = 315$

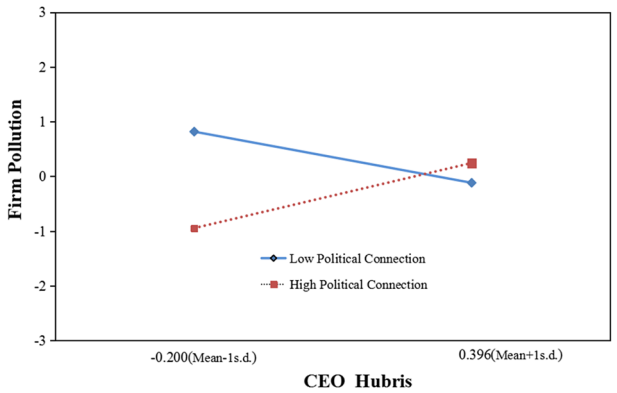

Fig. 2 Moderating effect of political connection on hubris–pollution relationship

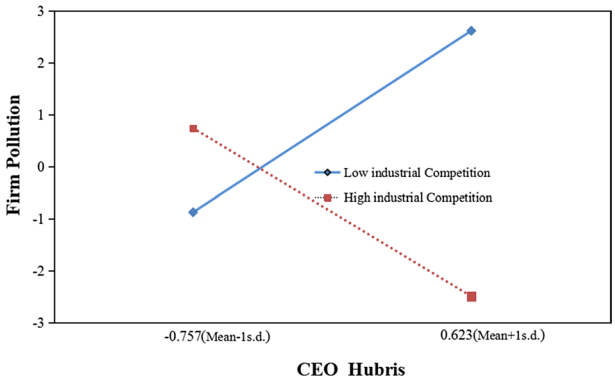

Fig. 3 Moderating effect of industrial competition on hubris–pollution relationship

of CEO hubris, we assigned the value of 1 to CEOs in the top quintile and − 1 to CEOs in the bottom quintile, while the remaining CEOs were considered neutral and took the value of 0 (Tang et al. 2015). The regression models were re-run using this new categorical variable of hubris. The results of the robustness test are exhibited in Table 5. As shown in Models 6–8, the results are similar to our previous ones, indicating that the hypotheses are robust to alternative measurements of CEO hubris.

As another alternative to the media-based measure, we employed a measure based on a CEO's relative compensation. CEOs tend to be more hubristic when they find that their salary is much higher than other top managers (Brown and Sarma 2007). Following Jiang et al. (2011), we used

Table 5 Robustness tests of ordered categorical measure of CEO hubris

	Dependent variable: firm pollution			
	Model 5	Model 6	Model 7	Model 8
(1) Control variables				
Slack	0.0258 (0.260)	0.0250 (0.252)	0.0202 (0.206)	−0.0274 (−0.284)
Duality	0.398*** (6.950)	0.412*** (6.932)	0.463*** (7.303)	0.468*** (7.322)
CEO tenure	−0.0103 (−0.819)	−0.00932 (−0.722)	−0.0104 (−0.831)	−0.0119 (−0.920)
Male CEO	−0.211 (−0.524)	−0.186 (−0.458)	−0.122 (−0.299)	−0.0896 (−0.257)
CEO age	−0.00178 (−0.231)	−0.00204 (−0.264)	−0.00582 (−0.744)	−0.00432 (−0.551)
Firm age	−0.0186** (−2.140)	−0.0179** (−2.055)	−0.0109 (−1.249)	−0.00969 (−1.134)
ROA	0.398 (0.345)	0.441 (0.381)	0.512 (0.456)	0.525 (0.459)
Leverage	0.489 (1.539)	0.480 (1.518)	0.501 (1.592)	0.322 (1.060)
Growth rate	−0.0266** (−2.567)	−0.0259** (−2.453)	−0.0297** (−2.465)	−0.0263** (−2.106)
Industry	0.382*** (3.994)	0.387*** (4.041)	0.392*** (4.022)	0.349*** (3.739)
INDIR	1.043 (1.474)	0.976 (1.357)	0.853 (1.222)	1.290* (1.855)
(2) Independent variable and moderating variables				
CEO hubris		−0.0601 (−0.822)	−0.0567 (−0.794)	−0.00535 (−0.0723)
SO			−0.368*** (−3.068)	−0.387*** (−3.237)
PC			0.0300 (0.200)	−0.0562 (−0.406)
Competition			−0.998 (−1.517)	−0.903 (−1.483)
(3) Moderating effects				
CEO Hubris × SO				0.212 (1.574)
CEO hubris × PC				0.572* (1.920)
CEO hubris × competition				−1.708* (−1.871)
Adjusted R^2	0.249	0.251	0.285	0.310
F value	9.07	8.45	7.27	6.02

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$ (two-tailed). $N = 315$

the salary of the CEO divided by the salary of the top three executives as a proxy for CEO hubris. As shown in Table 6, the results are still similar to previous ones.

Our sample only employs firms that appeared on the Pollution List. The exclusion of unlisted firms may thus have entailed sample selection bias and endogeneity. We applied Heckman's two-stage method to correct for this selection bias (Heckman 1979). The first-step regression was conducted to obtain the 'Inverse Mill Ratio (IMR)' (Katmon and Al Farooque 2017). In the second-step regression, the IMR was introduced into all models of Table 7. Table 7 shows the regression estimates of the above two steps. As shown in Panel A of Table 7, we conducted the probit model for the first-step regression, with the sample of Chinese-listed companies from 2015 to 2017 where the dependent variable was 'Firm Pollution Dummy', which equalled 1 if the firm appeared on the Pollution List, and 0 otherwise. The independent variables included (1) the log value of the number of employees (since labour intensive firms are more likely to be environmentally irresponsible), (2) cash, the free cash flow of the company (since firms with insufficient free cash flow may cut their costs on environmental protection), (3) INDIR, the independent director ratio (since independent directors who cherish their own reputation may help firms avoid pollution), (4) the percentage of SO. Panel B of Table 7 shows that the coefficients of IMRs are insignificant. This suggests that our model does not have a problem with sample selection bias (Katmon and Al Farooque 2017). The results generated after controlling for the sample selection bias by introducing the IMR are presented in Panel B of Table 7. The results of Models 13–15 in Panel B are similar to those of Models 2–4 in Table 4, where CEO hubris is positively associated with firm pollution, while competition negatively moderates the relationship between CEO hubris and firm pollution.

Discussion

General Discussion

First, the results show that CEO hubris is significantly positively correlated with firm pollution, supporting the hypothesis that hubristic CEOs are more inclined to engage in environmental misconduct, which is in line with the findings of Tang et al. (2015), which suggest a positive relationship

Table 6 Robustness tests of salary-based measure of CEO hubris

	Dependent variable: firm pollution			
	Model 9	Model 10	Model 11	Model 12
(1) Control variables				
Slack	0.0258 (0.260)	0.0243 (0.246)	0.0203 (0.207)	−0.0287 (−0.299)
Duality	0.398*** (6.950)	0.401*** (6.953)	0.452*** (7.234)	0.468*** (7.388)
CEO tenure	−0.0103 (−0.819)	−0.0115 (−0.883)	−0.0122 (−0.963)	−0.0128 (−0.975)
Male CEO	−0.211 (−0.524)	−0.193 (−0.480)	−0.134 (−0.332)	−0.0786 (−0.229)
CEO age	−0.00178 (−0.231)	−0.00189 (−0.244)	−0.00562 (−0.715)	−0.00433 (−0.549)
Firm age	−0.0186** (−2.140)	−0.0189** (−2.189)	−0.0119 (−1.372)	−0.0101 (−1.195)
ROA	0.398 (0.345)	0.358 (0.307)	0.442 (0.390)	0.489 (0.426)
Leverage	0.489 (1.539)	0.502 (1.577)	0.518 (1.631)	0.330 (1.086)
Growth rate	−0.0266** (−2.567)	−0.0260*** (−2.672)	−0.0298*** (−2.629)	−0.0258** (−2.180)
Industry	0.382*** (3.994)	0.378*** (3.958)	0.386*** (3.956)	0.346*** (3.713)
INDIR	1.043 (1.474)	1.136 (1.618)	0.985 (1.437)	1.373** (2.031)
(2) Independent variable and moderating variables				
CEO hubris		0.338 (0.947)	0.230 (0.638)	0.250 (0.677)
SO			−0.360*** (−2.982)	−0.380*** (−3.171)
PC			0.0336 (0.226)	−0.0544 (−0.392)
Competition			−1.000 (−1.501)	−0.892 (−1.456)
(3) Moderating effects				
CEO hubris × SO				0.213 (1.646)
CEO hubris × PC				0.580** (1.991)
CEO hubris × competition				−1.715* (−1.867)
Adjusted R^2	0.249	0.252	0.285	0.293
F value	9.07	8.52	7.07	5.94

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$ (two-tailed). $N = 315$

between CEO hubris and corporate social irresponsibility. A hubristic CEO is more likely to exhibit blind optimism, and when making ecological relevant decisions, will tend to insufficiently consider stakeholders' interests and pressures, thus leading to environmental violations (Zou et al. 2015).

Second, we find different moderating effects of different proxies of state logic: SO has an insignificant moderating effect, while PC has a significant positive moderating effect. The former result is surprising; this may be because although the state provides SOEs with more resources, it does not exert enough control on corporate environmental misconduct, leading hubristic CEOs to ignore that pressure. Some studies even find that SOEs have more environmental violations than their private counterparts (Maung et al. 2016). The latter results indicate that PC would strengthen the positive hubris–pollution relationship, i.e. close ties with the government enables hubristic CEOs to have even more discretion in environmental violations, which supports the negative rather than the positive perspective of PCs in ecological outcomes (Zhang 2017).

Third, the result shows that the market logic of industrial competition plays a significant negative moderating role in the hubris–pollution relationship: when industry competition is more intensive, the effect of CEO hubris on firm pollution is mitigated. Although one might imagine that when competition is strong, hubristic CEOs would spend fewer resources on environmentally responsible solutions in order to outperform their competitors, it appears that intensified competition makes CEOs more wary, since any environmental wrongdoing may be attacked by their competitors. Also, according to the resource dependence theory, in highly competitive markets, firms have to resort more to their stakeholders' resources and support—such as governmental subsidies and positive media reports. These reports can be achieved by good environmental performance while environmental misconduct may be disclosed by the media and punished by the government. Tang et al. (2015) also find that a more competitive market will suppress CEOs' hubris about their capabilities and reduce their unethical activities in order to obtain support from stakeholders.

Theoretical Contributions

This research has several important contributions. First, it contributes to managerial hubris and UET, as previous research mainly investigates the effects of observable

Table 7 Results with Heckman two-stage procedure

Panel A: the first-step regression—model employed to estimate inverse Mills

Variable	Firm size	Cash	INDIR	State share	Year	Cons	*N*	Pseudo R^2	LR chi^2
Firm pollution dummy	0.430***	0*	−2.445***	−0.785***	YES	−10.10***	5314	0.2079	499.4
	(0.0227)	(0)	(0.587)	(0.0705)		(0.527)			0

Panel B: the second-step regression—after introducing inverse Mills

	Dependent variable: firm pollution		
	Model 13	Model 14	Model 15
CEO hubris	0.187** (2.213)	0.192** (2.335)	0.072 (0.667)
SO		−0.288** (−2.261)	−0.298** (−2.338)
PC		0.009 (0.056)	− 0.004 (− 0.025)
Competition		0.094 (0.524)	0.116 (0.708)
CEO Hubris × SO			0.223 (1.134)
CEO Hubris × PC			0.241 (0.758)
CEO Hubris × Competition			−0.575** (−2.000)
Slack	0.057 (0.581)	0.037 (0.373)	0.012 (0.117)
Duality	0.435*** (7.267)	0.457*** (7.175)	0.458*** (7.171)
CEO Tenure	−0.010 (−0.779)	−0.012 (−0.933)	−0.012 (−0.936)
Male CEO	0.113 (0.311)	0.038 (0.108)	0.030 (0.085)
CEO age	−0.004 (−0.525)	−0.004 (−0.554)	−0.003 (−0.454)
Firm age	−0.016* (−1.855)	−0.014 (−1.531)	−0.013 (−1.472)
ROA	−0.500 (−0.426)	−0.151 (−0.131)	−0.167 (−0.143)
Leverage	0.194 (0.521)	0.317 (0.850)	0.205 (0.551)
Growth Rate	−0.018 (−1.622)	−0.026* (−1.952)	−0.023* (−1.768)
Industry	0.386*** (4.018)	0.379*** (3.691)	0.363*** (3.496)
INDIR	1.265* (1.866)	1.061 (1.567)	1.158* (1.671)
IMR	−0.219** (−2.265)	−0.137 (−1.311)	−0.138 (−1.339)
Cons	0.175 (0.326)	0.013 (0.024)	0.009 (0.017)
Year	YES	YES	YES
Wald chi^2	110.28	113.55	116.73
N	317	317	317

Notes: *t* statistics in parentheses; *$p<0.05$, **$p<0.01$, ***$p<0.001$ (two-tailed)

managerial characteristics (e.g. age, gender) on economic outcomes (Robertson et al. 2017), we explore the effect of the unobservable managerial characteristic of hubris on ecological outcomes. While extant work has established the implications of CEO hubris for corporate financial performance (Park et al. 2018) or social responsibility (Tang et al. 2015), it is still not clear how CEO hubris influences corporate environmental activities. Based on the framework proposed by Petit and Bollaert (2012) and Park et al. (2018), we argue that hubristic CEOs tend to become entrenched and unethical, especially in firm pollution, and our findings support this. We also explored the conditions under which hubris has a lesser or greater effect on pollution, which may help understand how CEO hubris triggers a firm's polluting behaviour. Thus, this study contributes to the literature by contextualising the effect of CEO hubris on corporate environmental behaviour, so that the hubris–pollution relationship is more precisely understood.

Second, our findings highlight the importance of institutional context in explaining the effect of CEO hubris on firm pollution. This study finds that the effect of hubristic CEOs depends upon different institutional logics, suggesting that researchers need to pay more attention to the boundary conditions of institutional contexts. Prior research has examined the mitigating mechanisms from internal governance perspectives (Park et al. 2018), but very few studies have examined potential boundary conditions from external institutional settings. Centred on institutional logics, this study introduces a set of institutional contingencies that mitigate or exacerbate the detrimental effect of CEO hubris on firm pollution. Specifically, we explored the moderating

roles of SO, PC and industrial competition on CEO hubris' ecological effects and find that the state logic of PC has increased CEOs' hubristic attitudes toward firm pollution, while the market logic of industrial competition mitigates these attitudes. The results demonstrate the distinct roles of different institutional logics in corporate environmental decision-making in China. By taking advantage of China's unique institutional environment, this study helps to clarify the roles that state and market institutional logics play in corporate ecological decision-making (Meng et al. 2016). Third, previous research on CEO hubris has mainly focused on Western contexts and little is known of the ecological outcomes of CEO hubris in transitional economies like China (Jiang et al. 2011; Li et al. 2017). On one hand, the Chinese institutional background has been criticised as dysfunctional for corporate environmental behaviour, which is significantly different from Western developed countries (Wei et al. 2017). On the other hand, China is experiencing fast growth with severe environmental damage, while Western countries' environmental problems are not so extensive. There is thus a conspicuous disparity between developed and developing economies and Western and non-Western countries (Han and Li 2015). This study thus contributes to the literature by generalising the ecological effect of CEO hubris in a non-Western context and could possibly serve as a basis for future research in other countries.

Practical Implications

First, the positive relationship of CEO hubris on firm pollution suggests the importance of monitoring the hubristic bias of CEOs (Schrand and Zechman 2012). Corporate governance mechanisms such as decentralised decision-making processes on ecological responsibility should be encouraged, since these involve the participation of, and represent the interests of, other stakeholders (Wong et al. 2011), which may mitigate the negative effects of CEO hubris on firm pollution. Also, there should be additional monitoring from the board to restrain the environmental misconduct of firms due to hubristic CEOs. As for CEOs, they should reflect on their own tendency to exhibit the leadership trait of hubris and attempt to be more objective and prudent when making environmentally relevant decisions.

Second, this research is also constructive for regulators, as it identifies that PC intensifies the environmental violations of hubristic CEOs, while SO is generally ineffective at curbing these violations. Thus, regulators should further strengthen the role of SO to make it effective and keep an eye on collusion between firms and government through PC. Also, additional attention should be paid to firms in industries of low competition intensity, as CEOs in these firms are more likely to be environmentally irresponsible due to hubris. Currently, there are still a number of industries—such as the power industry, the oil industry—which are highly monopolised; this might encourage hubristic CEOs to engage in unethical behaviour without much stakeholder pressure. Thus, extensive market-oriented reforms should be strengthened so as to build a more fair and competitive industrial environment and spur CEOs to take up more environmental responsibilities (Shi and Sun 2015).

Limitations and Future Research Directions

This paper is subject to a few limitations which deserve future research. First, though the Pollution List is authoritative and the environmental activities of the firms on the list are well worthy of focus, the sample only includes the most polluting firms, while neglecting other less polluting ones, which means that the sample is limited. Further studies should explore whether the same relationship between hubris and polluting activities can be found among CEOs of the less polluting firms (those not included in the list). Also, as the Pollution List was initiated in 2015; the original sample has only 319 observations over a period of 3 years. Therefore, future research may extend the scope of our study to see if the results remain robust when more data become available.

Second, besides state logic and market logic, the relationship between CEO hubris and firm pollution may also be influenced by the power distribution of top managers, the internal and external governance environment and so on. These factors may have moderating or mediating effects on the relationship and they open up promising avenues for future research.

Third, we only focused on the Chinese-listed companies, so the findings may not work in firms in developed countries as their state, market and media mechanisms are quite different. In order to deal with these problems, it is necessary to carry on future research within different countries so as to establish a comparison with the findings of this study.

Conclusion

The goal of this study was to explore whether and when CEO cognitive bias affects corporate unethical ecological outcomes. To do so, this paper, based on UET and institutional theory, examined the influence of CEO hubris on firm pollution in transitional China by considering the moderating effects of institutional logics. The results showed that CEO hubris significantly leads to more firm pollution, and that state logic has diverse effects: while the moderating role of SO is not significant, PC positively moderates the hubris–pollution relationship. Moreover, the market logic of industrial competition negatively moderates the focal relationship. Together, these ideas and findings contribute to

research on the cognitive bias of top managers and its effect on firm environmental performance, as well as the effect that the boundary conditions of institutional contexts have on this relationship.

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Compliance with Ethical Standards

Conflict of interest All authors state that they have no conflict of interest.

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

Appendix

Calculation of the Pollution Index

Since 2015, the Institute of Public and Environmental Affairs (IPE), a non-profit environmental research organisation registered in 2006 in China, has collected real-time monitoring pollutant emissions data published on provincial-level platforms for Chinese publicly listed companies. In 2007, China implemented the state key monitoring company list system, in which all major polluting enterprises are included, accounting for 65% of the nation's total enterprise emissions. Inaugurated in 2013, the provincial-level platforms require all state key monitoring companies to report their emissions in real time. Based on these raw data, IPE weekly compiles a Pollution List containing the 20 highest polluters based on the Pollution Index. The Index considers the frequency and severity of a firm's pollution discharges above the regulatory standard, which is calculated as follows:

$$\begin{aligned}\text{Pollution Index} = {} & \text{exceeding days of a week}/7 * 50\% \\ & + \text{exceeding rate of the week} * 50\%,\end{aligned}$$

where an exceeding day of a firm is identified if a certain pollutant in the same discharge outlet exceeds regulatory standards three times a day, an exceeding rate is calculated as 'pollutant discharges/regulatory standard * 100% − 1'.

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